



X35

DIGITAL ELECTRONIC REFRIGERATION UNITS CONTROLLER



OPERATING INSTRUCTIONS



DIFFUSION Service

TOUTE LA RÉGULATION

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PREFACE

This manual contains the information necessary for the product to be installed correctly and also instructions for its maintenance and use; we therefore recommend that the utmost attention is paid to the following instructions and to save it.

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Whenever a failure or a malfunction of the device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional electromechanical devices which will guarantee safety.

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1.1 General description

The **X35** model is a digital electronic microprocessor controller that can be used typically for **refrigeration applications**. It has **ON/OFF temperature control** and **defrost control at defined times** (Real Time Clock Defrosting), at time intervals, by arrival at temperature or by length of time of continuous compressor operation through stopping the compressor, electric heating or hot gas/cycle inversion.

The instrument has up to **4 relay outputs**, up to **4 inputs configurable** for PTC, NTC and Pt1000 temperature probes, and **2 digital inputs**. It can be also equipped with an **RS485 serial communication interface** with **MODBUS-RTU** communication protocol, a **calendar clock** (Real Time Clock) and an **NFC interface** for **parameters programming**.

The calendar clock allows to program defrosting events, auxiliary output switching, control Set Point changes, instrument ON/OFF, etc. at pre-set times (max. 14 daily and 98 weekly events).

A further feature of the calendar clock instrument version is the HACCP function which can store the last 10 occurred alarms (alarm type, start, duration and temperature peaks).

Two Digital Inputs are always available and, as an alternative to **Pr3** and **Pr4** temperature probe inputs, two other digital inputs can be configured.

1.2 Front panel description



1. **[P] Key:** Used to set the **Set Point** (press and release) and to program the function parameters (pressed for 5 s). In programming mode [P] is used to enter at parameters edit mode and confirm the values. In programming mode [P] can be used together with the [▲] key to change the programming level of the parameters. When the keyboard is locked [P] pressed together with the [▲] button for 5 s (or pressed alone for 9 s) key to unlock the keyboard.
2. **[▼]/Aux Key:** In programming mode is used for decreasing the values to be set and for selecting the parameters. Hold pressed for 1 s, while in *Normal* mode, it can also be programmed via parameter t_{Ed} to carry out other functions such as selecting the *Eco* mode, activating the **Aux** output, etc. (see functions of keys [U]/[P] and [▼]/Aux).
3. **[▲]/[Defrost] Key:** In *Normal* mode can be used to **start/stop a manual defrost** (pressed for 5 s). In programming mode [▲] is used to increase the value to be set and to select the parameters. In programming mode, [▲] can be used, together with key [P] to change parameters level. Pressed together with [P] key for 5 s allows the keyboard unlock.
4. **[U]/[P] Key:** Press and release the key to display the instrument variables (measured temperatures etc.). In programming mode press [U] for 2 s to return in *Normal* mode. Hold pressed for 1 s, while in *Normal* mode, it can also be programmed via parameter t_{uF} to carry out other functions such as turn ON/OFF (stand-by) the device, activate the **Aux** output, etc. (see functions of keys [U]/[P] and [▼]/Aux).

5. **LED SET:** During the normal operating mode, signals that a key has been pressed. In programming mode indicates the programming level of the parameters: not protected (ON), protected (**flashing**).
6. **LED [Cooling Symbol] - COOL:** Indicates the control output status (compressor or temperature control device) when the instrument is programmed for **cooling** operation: on (**on**), off (**off**) or inhibited (**flashing**).
7. **LED [Heating Symbol] - HEAT:** Indicates the control output status (compressor or temperature control device) when the instrument is programmed for **heating** operation: on (**on**), off (**off**) or inhibited (**flashing**).
8. **LED [Defrost Symbol]:** Indicates: Defrost in progress (**on**) or drainage time in progress (**flashing**).
9. **LED [Fan Symbol]:** Shows the Evaporator Fan(s) output status: on (**on**), off (**off**) or inhibited (**flashing**).
10. **LED [Alarm Symbol]:** Shows the Alarm active status (**on**), off (**off**) and Acknowledged or Latched (**flashing**).
11. **LED Aux:** Shows the Auxiliary output status: on (**on**), off (**off**) or inhibited (**flashing**).
12. **LED [Clock Symbol]:** Indicates that the internal clock is running. If it is steady lit, the current time is presumably correct. If flashing slowly, it means that there is a clock error (clock chip not working). If flashing rapidly, means the clock battery is drained.
13. **LED Stand-By:** When the instrument is in Stand-by mode is the only lit LED.

PROGRAMMING

2.1 Fast Set Point programming

The normal mode to program the Set Points is done by momentarily pressing the [P] key, the display shows SP (or SPE or SPH) alternated to the programmed value. To change the value shown press the [▲] key to increase its value or [▼] to decrease it.

However, through parameter t_{Ed} is possible to determine whether and which Set Points can be modified with the fast mode. t_{Ed} is programmable between 0 (**OFF**) and 6:

0. **oF** - No Set Point can be changed with this procedure (the pression of the [P] key has no effect);
1. Only **SP** (*normal* Set Point) can be adjusted;
2. Only **SPE** [*Eco* (*Eco*) Set Point] can be adjusted;
3. Both **SP** and **SPE** can be adjusted;
4. Only the **Active Set Point** (**SP/SPE**) can be adjusted;
5. Can be adjusted **SP** and **SPH** (*Turbo* or, if independent, the Heating Set Point);
6. Can be adjusted **SP**, **SPE** and **SPH**.

For example, if the parameter $t_{Ed} = 1$ or **3**, the procedure is as follows:

- Press and release key [P], the display shows SP alternated to its value;
- To modify the Set Point, press the keys [▲]/[▼] to increase/decrease its value;
- If only the **SP** ($t_{Ed} = 1$) is changeable, once reached the desired value, press the [P] key to exit the Set Point programming mode;
- If also the **SPE** is programmable ($t_{Ed} = 3$), the procedure is not ended and at the [P] pressure the instrument does not exit the Set Point programming procedure, but displays SPE alternated to its value ready for changes;
- To modify the *Eco* Set Point, press the keys [▲]/[▼] to in-

crease/decrease its value;

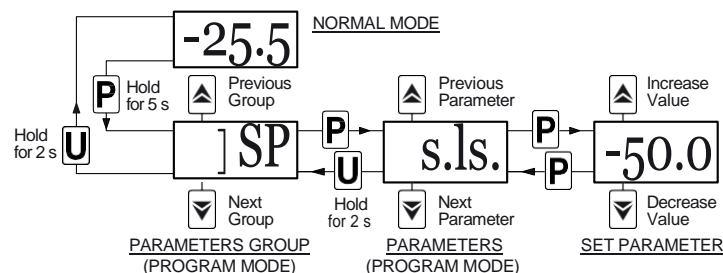
- Once the desired value is reached press the key **[P]** to exit Set Point programming mode;
- If the *Turbo* (or independent heating) Set Point can also be set ($t.PP = 6$) by pressing and releasing the key **[P]** again, the display shows **SPH** alternated with its value. Changes are made with **[▲]/[▼]** keys as for the other Set Points.

Exiting the Set Point programming mode is achieved by pressing the **[P]** key or automatically if no keys are pressed for about 10 seconds. After that time the display returns to the normal function mode.

2.2 Standard mode parameters programming

To access the instrument functional parameters **when password protection is disabled**:

- Press the **[P]** key and keep it pressed for about 5 s, after which the display shows the code that identifies the first group of programmable parameters (1st group =]SP).
- Using the **[▲]/[▼]** keys select the desired parameters group, then enter in that group pressing the **[P]** key, the display starts showing the code of the first parameter of the group.
- Using the **[▲]/[▼]** keys select the desired parameter and, pressing the **[P]** key, enter the change parameter mode (the display **alternately shows the parameter code and its setting value**) that allows to change the parameter value with the **[▲]** and **[▼]** keys.
- Once the desired value has been set, press the **[U]** key again: the new value will be stored and the instrument returns to the group parameter list showing only the **parameter code**.
- Pressing the **[▲]/[▼]** keys it is possible to select another parameter and change it as described.
- To return to the “Group selection mode” keep the **[U]** key pressed for 1 s until the instrument shows the group code.
- With **[▲]/[▼]** keys it is possible to select another group of parameters and repeat the changing sequence.
- To exit the programming mode, **press no keys for about 30 s** or keep the **[U]** key pressed for 2 s until the controller exits the programming mode.



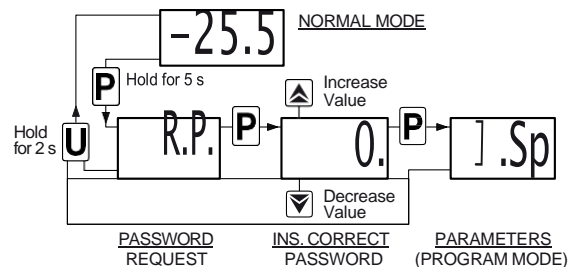
2.3 Parameter Protection Using a Password

The instrument has a parameter protection function with a password that can be customized using the $t.PP$ parameter. To protect the parameters, set the desired Password Number at parameter $t.PP$ and exit the programming procedure. When the protection is active, keep the **[P]** key pressed for about 5 s, after which the display shows $r.P$. Press **[P]** again, the display shows 0.

Now, using the **[▲]/[▼]** keys, set the programmed password number and press again the **[P]** key.

If the password number inserted is correct, the display shows the code that identifies the first group of programmable parameters and it will be possible to program the instrument in the same ways described in the previous paragraphs.

The password protection can be disabled setting $t.PP = 0F$.



- Notes:**
1. All parameters are configured by default as “protected” so that by simply setting the $t.PP$ parameter they are all password protected.
 2. If the Password gets lost, just switch OFF and ON the instrument supply, push **[P]** key during the initial test and keeping the key pressed for 5 s. In this way it is possible to have access to all the parameters, verify and modify the parameter $t.PP$.

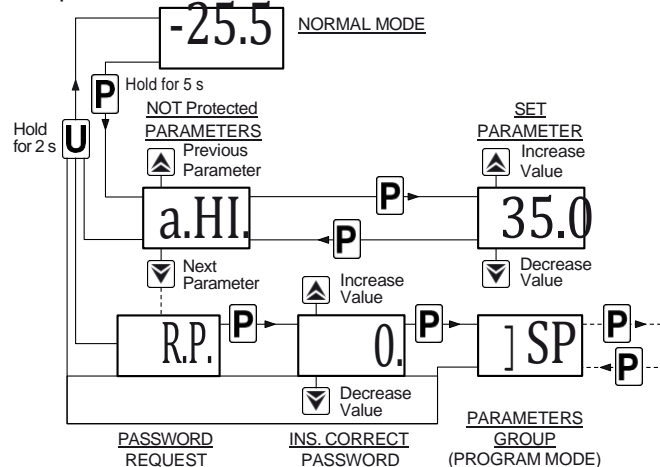
2.4 Customized mode parameters programming (parameters programming level)

The password protection hides all the configuration parameters behind a factory set password to avoid unwanted changes being made to the controller set up.

To make a parameter accessible without having to enter the password when $t.PP$ password protection is activate follows this procedure:

- Enter the programming mode using the $t.PP$ Password, select the parameter that must be accessible with no password protection.
- Once the parameter has been selected, if the **SET LED** blinks means that the parameter is programmable by entering the password (is protected), if the **SET LED** is steady lighted means that the parameter is programmable without password (is not protected).
- To change the parameter visibility, press the **[U]** key and keeping it pressed also press the **[▲]** key. The **SET LED changes its state** indicating the **new parameter access level** (**on** = not protected; **blinking** = protected by password).

In case some parameters are not protected, accessing the programming mode the display **first shows the not protected parameters**, then the $r.P$ parameter and, after inserting the password number, will be possible to access the protected parameters.



With regard to setting unprotected parameters, an exception is HACCP alarm-related parameters ($H.01$, $H.02$ etc. which are visible only when there are alarms stored in memory) whose display level can be set via the $t.HA$ parameter.

If $t.HA = 1$ the parameters related to stored HACCP alarms

are visible only within the]HA group (which can be displayed like all other groups without a password if t.PP = oF or by entering the selected t.PP password).

If t.HA = 2 the parameters related to stored HACCP alarms are visible both within the]HA group (which can be displayed like all other groups without a password if t.PP = oF or by entering the selected t.PP password) and as unprotected parameters also if the password is active.

2.5 Reset parameters to default value

The instrument allows the reset of the parameters to those values programmed in factory as default.

To restore the default parameters value set value -48 at r.p password request.

Therefore, to make the reset to the default parameters, enable the Password using the t.PP parameter so that the r.p setting is requested, at this point insert -48 instead of the programmed access password number.

Once confirmed the password with the [P] key the display shows "---" for 2 s after which the instrument resets all the parameters to the factory default setting.

2.6 Keyboard lock function

On the instrument it is possible to completely lock the keyboard. This function is useful when the controller is in an accessible area and changes must be avoided.

To activate the keyboard lock it is enough program the parameter t.Lo to a value different than oF.

The t.Lo value is the keys inactivity time after which the keyboard will be automatically locked.

Therefore, pressing no buttons for the time set at t.Lo, the instrument automatically disable the normal keys functions. When the keyboard is locked, if any of the key is pressed the display shows Ln to point out that the lock is active.

To unlock the keyboard it is enough to contemporarily press [P] + [Keys] and keep them pressed for 5 s (or the [P] key alone for 9 s), after which the label LF appears on the display and all the key functions will be available again.

2.7 Setting the current time and date

When the instrument is equipped with the internal calendar/clock, this must be enabled and programmed to the current time and day of the week using the c.CL parameter and to the current date using the c.dt parameter.

After the c.CL parameter has been selected, press the [P] key repeatedly to cycle through the following options:

- h. + 2 digits for the hour of day in 24h format (e.g.: h. 13);
- n. + 2 digits for the minutes (e.g.: n. 45);
- d. + 1 digit for the day of the week (e.g.: d. 1);
- oF Clock disabled.

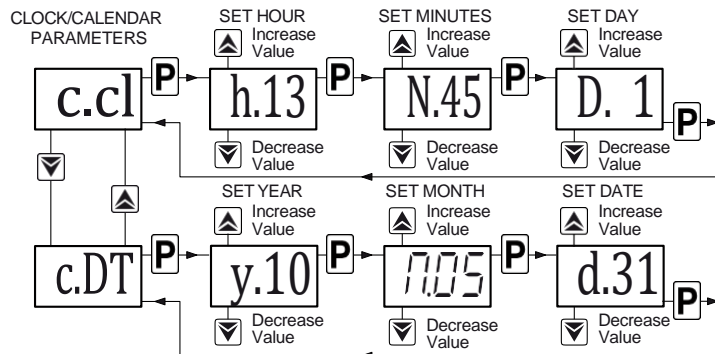
The days of the week are numbered as follows:

- d. 1 Monday;
- d. 2 Tuesday;
- d. 3 Wednesday;
- d. 4 Thursday;
- d. 5 Friday;
- d. 6 Saturday;
- d. 7 Sunday.

After selecting the c.dt parameter, press the [P] key repeatedly to cycle through the following options:

- y. + 2 digits for the current year (e.g.: y. 10);
- M. + 2 digits for the and current month (e.g.: M. 05);

d. + 2 digits for the and current date (e.g.: d. 31).



When the internal clock is running, the ☺ LED is lighted.

2.8 Scheduling events at defined times (models with RTC)

The events are programmable through the 14 parameters (c.01... c.14) contained in the]CE group.

Exactly as for current time, because the parameters for time-related functions require multiple values to be input, these parameters are programmed in the following way:

After selecting the desired parameter, press the [P] key repeatedly to cycle through the following parameters:

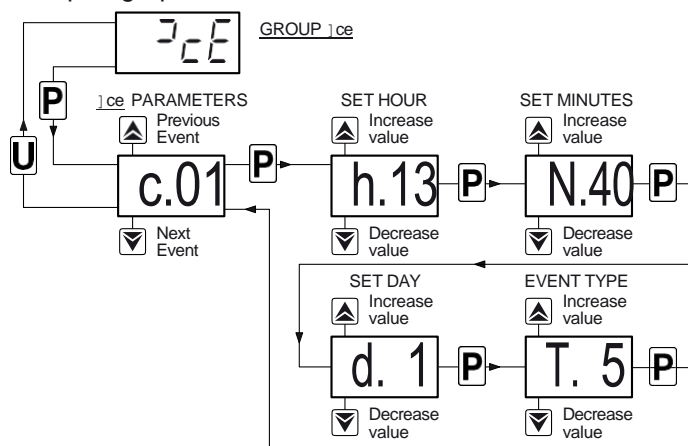
- h. + 2 digits for the hour of day in 24h format (e.g.: h. 13);
- n. + 2 digits for the minutes of the hour (e.g.: n. 40);
- d. + 1 digit for the day of the week (e.g.: d. 1);
- t.. + 1 digit for the event type to be executed at the programmed time (e.g.: t. 5).

The days of the week are numbered as follows:

- d. 1 Monday;
- d. 2 Tuesday;
- d. 3 Wednesday;
- d. 4 Thursday;
- d. 5 Friday;
- d. 6 Saturday;
- d. 7 Sunday;
- d. 8 Every day;
- d. 9 Monday, Tuesday, Wednesday, Thursday, Friday;
- d.10 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday;
- d.11 Saturday and Sunday;
- d. oF No day (event disabled).

The instrument offers 14 event programming parameters, allowing a maximum of 14 x 7 = 98 weekly events to be scheduled (using d. 8).

For the event types that can be programmed, see the relevant paragraph.



2.9 Displaying HACCP alarms (models with RTC)

The HACCP (Hazard Analysis and Critical Control Points) function causes the instrument to record the last 10 alarms that have occurred together with the information useful to determine the criticality of the alarm. The function is available only for those instruments equipped with the calendar clock. The following HACCP alarms can be stored in memory:

HACCP alarm code	Alarm
H1	Maximum temperature alarm H1
L1	Minimum temperature alarm L1
H2	Maximum temperature alarm H2
L2	Minimum temperature alarm L2
bo	Power failure alarm (black-out)
AL	Alarm from digital input

These Alarms are displayed using the same procedure as for programming the parameters (parameters H.01 ÷ H.10 inside]HA group).

As for the events scheduling or the time set, the time-related functions parameters require multiple values to be input, also the HACCP Alarms information are inserted in various field that are to be scrolled to be displayed.

The Alarms info are contained in the]HA group. To access the alarm list, press the [P] key while the instrument displays]HA group acronym, to select the desired alarm (H.01... H.10) use the [▲][▼] keys, then, press [P] repeatedly to display the alarm information (alarm code, time etc.).

The instrument shows:

- Alarm type (A. + 2 digits of the HACCP alarm code);
 - Alarm start time HACCP (y. = year, M. = month, d. = day, h. = hours, n. = minutes);
 - HACCP alarm duration (E. = hours, e = minutes);
 - Critical temperature (max. peak if Hi alarm or min. peak if Lo or other alarm).
- These parameters are automatically sorted by the instrument from the most recent (H.01) to the oldest (H.10) every time an alarm is recorded or an alarm is canceled.

If the alarms exceed the number of 10, the instrument deletes the data relating to the oldest alarm by overwriting them with the information of the most recent one.

When this occurs, the instrument increases the value of the H.dL parameter by one unit through which it is possible to view the number of alarms that the instrument has been forced to delete because they exceed the allowed memory.

Once the alarm parameter to be viewed has been selected, the flashing label means that the alarm has never been displayed (therefore acknowledged).

To acknowledge an alarm, simply access the parameter using the [P] key and view it. At the next display, the label of the parameter will be fixed.

If the alarm is still in progress at the time of display, data are shown but the alarm is not acknowledged.

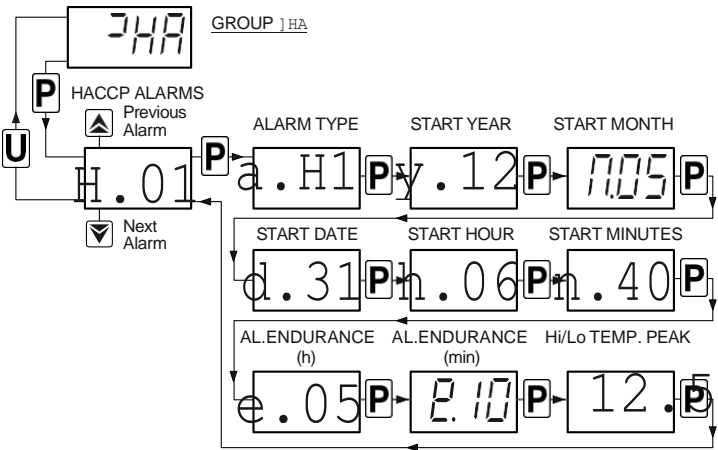
In the presence of unacknowledged HACCP alarms (therefore also in progress) the instrument shows the HAC message on the display alternated with the normal display.

Within the parameter, the data will be displayed sequentially through subsequent presses of the [P] button. The alarm is canceled if the [▼] button is held down for more than 5 s while viewing one of the alarm data.

Similarly, it is possible to reset the value of the H.dL param-

eter by keeping the key [▼] pressed for more than 5 s while the display shows the number of cleared alarms.

As regards the configuration and operation of the HACCP alarms, see the relative paragraph.



USAGE WARNINGS

3.1 Admitted usage

The instrument has been projected and manufactured as a measuring and control device to be used according to EN60730-1 at altitudes operation below 2000 m.

The use of the instrument for applications not expressly permitted by the above mentioned rule must adopt all the necessary protective measures.

The instrument **MUST NOT BE USED** in dangerous environments (flammable or explosive) without adequate protection. The instrument used with NTC 103AT11 probe (identifiable by the printed code "103AT-11" visible on the sensor part) or Pt1000 is compliant with standard EN 13485 ("Thermometers for measuring the air and product temperature for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream") with the following classification: [EN13485 air, S, A, 1, - 50°C +90°C].

Remember that the end user must periodically check and verify the thermometers in compliance with standard EN 13486. The installer must ensure that EMC rules are respected, also after instrument installation, if necessary using proper filters.

INSTALLATION WARNINGS

4.1 Mechanical mounting

The instrument, in case 78 x 35 mm, is designed for flush-in panel mounting. Make a hole 71 x 29 mm and insert the instrument, fixing it with the provided special brackets.

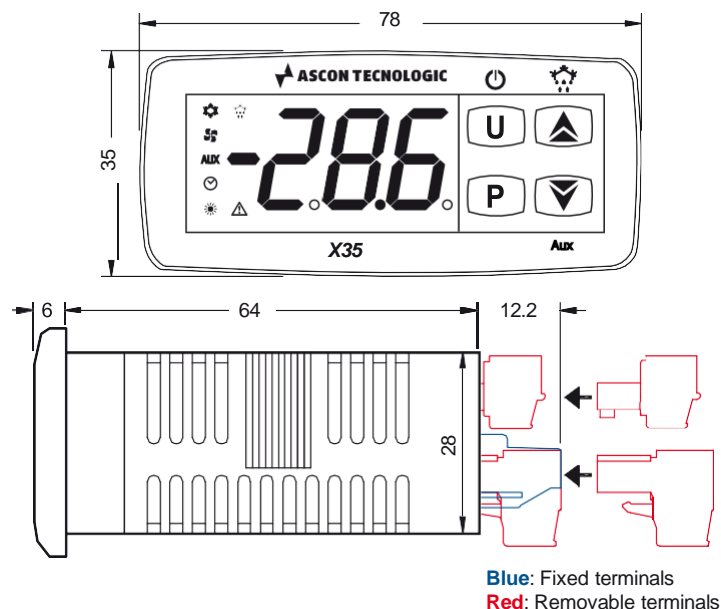
In order to obtain the declared front protection degree use the screw type bracket (optional).

Avoid placing the instrument in environments with very high humidity levels or dirt that may create condensation or introduction of conductive substances into the instrument.

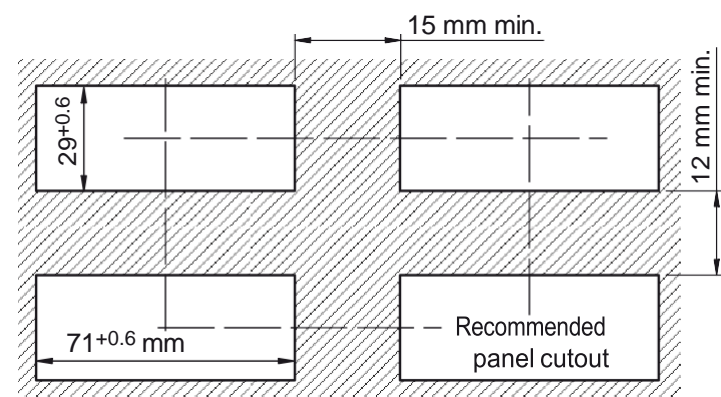
Ensure adequate ventilation to the instrument and avoid installation in containers that house devices which may overheat or which may cause the instrument to function at a higher temperature than the one permitted and declared.

Connect the instrument as far away as possible from sources of electromagnetic disturbances such as motors, power relays, relays, solenoid valves, etc.

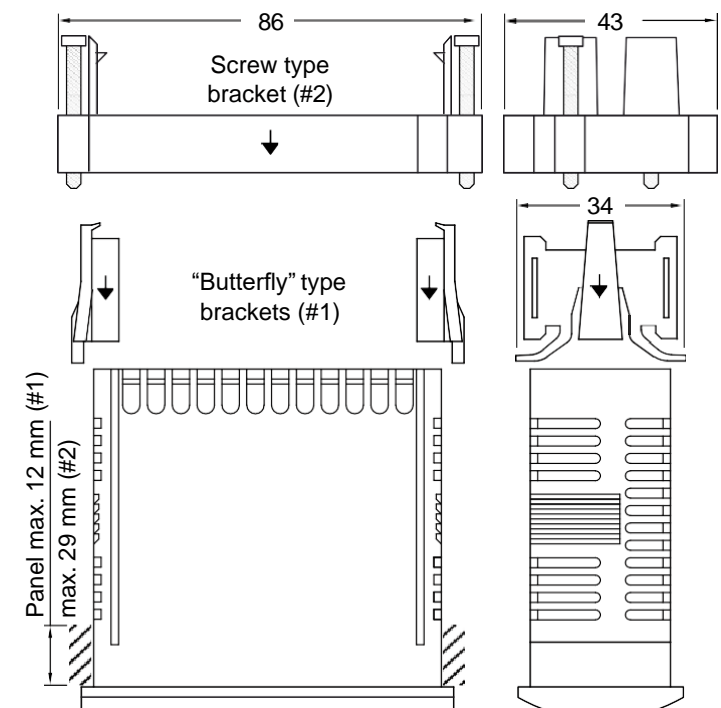
4.1.1 Mechanical dimensions [mm]



4.1.2 Panel cut-out



4.1.3 Mounting



4.2 Electrical connections

Carry out the electrical wiring by connecting only one wire to each terminal, according to the following diagram, checking that the power supply is the same as that indicated on the instrument and that the load current absorption is no higher than the maximum electricity current permitted.

As the instrument is built-in equipment with permanent connection inside housing, it is not equipped with either switches or internal devices to protect against overload of current: the installation will include an overload protection and a two-phase circuit-breaker, placed as near as possible to the instrument, and located in a position that can easily be reached by the user and **marked as instrument disconnecting device** which interrupts the power supply to the equipment.

It is also recommended that the supply of all the electrical circuits connected to the instrument must be properly protected, using devices (ex. fuses) proportionate to the circulating currents.

It is strongly recommended that cables with proper insulation, according to the working voltages and temperatures are to be used.

Furthermore, the probe input cable must be kept separate from line voltage wiring.

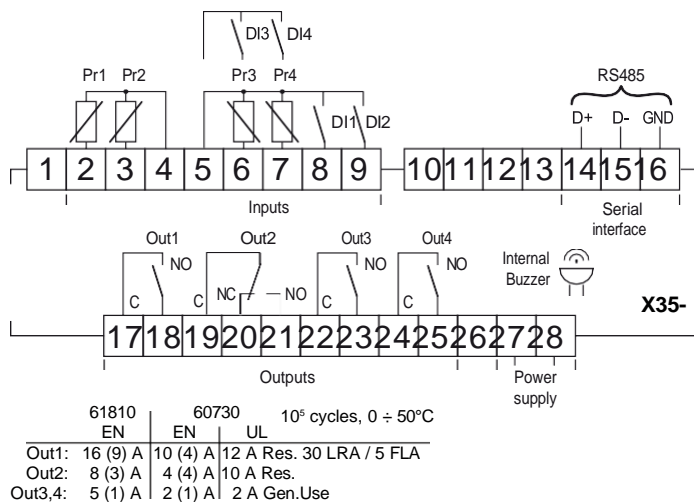
When a probe shielded cable is used, the protection shield should be connected to ground at only one side.

For the electrical supply of the **G** (12... 24 VDC) type instruments it is recommended to use an external TCTR transformer, or with equivalent features and to use a transformer for each instrument because there is no insulation between input and power supply.

For the **X** version of the instrument (12 VDC power supply) it is necessary to use a power supply capable of supplying the indicated voltage.

We recommended that a check should be made that the parameters are those desired and that the application functions correctly **before connecting the outputs** to the actuators so as to avoid malfunctioning that may cause irregularities in the plant that could cause damage to people, things or animals.

4.2.1 Electrical wiring diagram



5.1 ON/Stand-by function

The instrument, once powered up, can assume 2 different conditions:

- **ON:** The controller uses the control functions.
- **Stand-by:** The controller uses no control function and the display is turned OFF except for the Stand-by LED.

The transition between Standby and ON status is equivalent to power ON the instrument providing the electrical power. If a power failure occurs, when the voltage returns the system always sets itself in the condition it was in before the black-out. The **ON/Stand-by** function can be selected:

- Pressing the key \square/\square for at least 1 s if parameter $t.UF = 3$ or 5 ;
- Pressing the key ∇/AUX for at least 1 s if parameter $t.Fb = 3$ or 5 ;
- Using the digital input if parameter $i.\square F = 7$ or 15 (where \square can be 1... 4);
- By programming a programmable event through the clock (if present).

5.2 Normal, Eco and Turbo operating modes

The instrument allows to pre-set up to 3 control Set Points:

SP Normal Set Point;
SPE Eco (economical) Set Point;
SPH Turbo Set Point.

Associated with each of them is the relative differential (hysteresis):

r.d Normal mode differential;
r.Ed Eco mode differential;
r.Hd Turbo mode differential.

The switching between these modes can be automatic or manual.

5.2.1 "Normal/Eco" mode operation

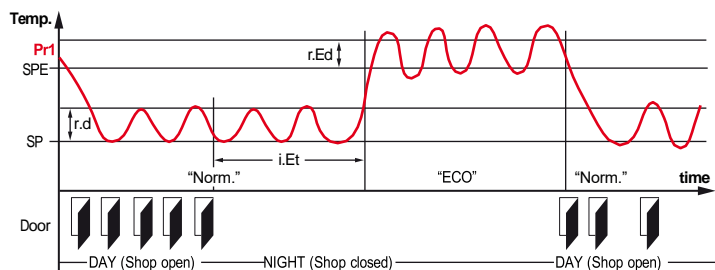
This operation mode can be used where it is necessary to switch between two different operating temperatures (e.g.: day/night or working days/holidays).

Normal/Eco mode can be selected manually:

- Pressing the \square/\square key if parameter $t.UF = 2$;
- Pressing the ∇/AUX key if parameter $t.Fb = 2$;
- By a digital input if parameter $i.\square F = 6$ (where \square can be 1... 4);

Normal/Eco mode can be selected automatically:

- After the door has been closed for time $i.Et$ (switching from Normal to Eco);
- When the door is opened if the **SPE** Set Point is active from parameter $i.Et$ (switching from Normal to Eco);
- After the door has been closed for time $i.tt$ since activation of the **SPE** Set Point from parameter $i.Et$ (switching from Eco to Normal);
- At defined times through the clock by programming events $t.6$ (switch to Eco mode) and $t.7$ (switch to Normal mode). For further information see the paragraph on programming events through the clock.



Example of automatic switching between Eco mode and Normal mode. During working hours the door is frequently opened and the controller remains in Normal mode. When the door has not been opened for time $i.Et$, the controller switches to Eco mode. As soon as the door is opened again, the controller reverts to Normal mode.

This function requires use of a digital input configured as $i.\square F = 1, 2$ or 3 (door open input).

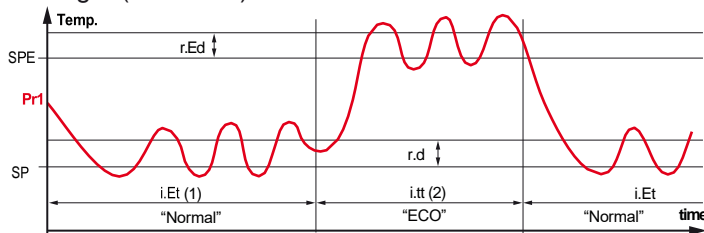
If $i.Et = 0F$ the Eco/Normal mode selection via the digital input configured as door, is disabled.

If $i.tt = 0F$ the Eco/Normal mode switching due to time-out is disabled.

When switched in Eco mode, the label **Eco** is displayed.

If $i.dS = Ec$ the display always shows the label **Eco** when the instrument is in Eco mode. Otherwise the label **Eco** appears approximately every 10 seconds alternated with the normal display set by the $i.dS$ parameter.

The Eco mode selection is always combined with the turn OFF the Auxiliary output function when used as a shop window light ($o.Fo = 3$).



Notes: 1. $i.Et$ time is reset all the times the door is opened. In the case shown, the door is always closed.

2. $i.tt$ time stops when the door is opened and the instrument immediately switches to Normal mode. In the case shown, the door is always closed.

5.2.2 Turbo/Normal/Eco mode operation

Turbo mode can be selected manually:

- Pressing the \square/\square key if parameter $t.UF = 4$;
- Pressing the ∇/AUX key if parameter $t.Fb = 4$;
- By a digital input if parameter $i.\square F = 8$ (where \square can be 1... 4).

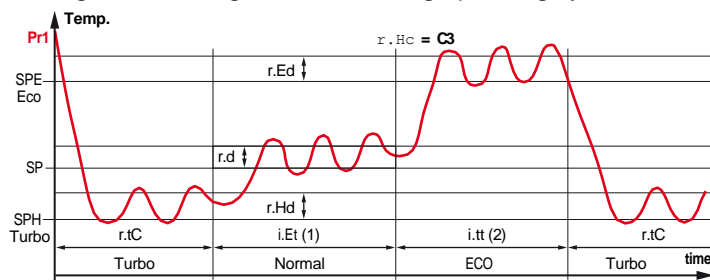
Turbo mode can be selected automatically:

- Leaving Eco mode (only if $r.HC = C3$);
- Every time the instrument is turned ON (only if $r.HC = C3$ and $Pr1 > SPE + r.Ed$).

The instrument quits Turbo mode automatically when $r.tC$ time has elapsed or Turbo mode can be manually ended using the programmed command (key or digital input); the instrument always returns to Normal mode.

Turbo mode can be applied manually, for example when the user wishes to lower the temperature of the products quickly after loading the refrigerator. However, Turbo mode is applied automatically to restore product temperature at the end of Eco mode.

Setting $r.HC = C3$ gives the following operating cycle:



- Notes:**
1. $i.Et$ time is reset all the times the door is opened. In the case shown, the door is always closed.
 2. $i.tt$ time stops when the door is opened and the instrument immediately switches to *Normal* mode. In the case shown, the door is always closed.

When switched ON, the instrument starts in the same mode it was in when it was switched OFF (*Normal* or *Eco*) unless the temperature at switch-on is higher than $SPE + r.Ed$. In this case (see the previous figure) a *Turbo* cycle is automatically started. After the $r.tC$ time has elapsed, the instrument automatically switches to *Normal* mode.

If the door is frequently opened the instrument remains in *Normal* mode. If however the door is not opened for $i.Et$ time, it automatically switches to *Eco* mode. The instrument remains in *Eco* mode until the door is opened again or, if set, until the $i.tt$ time-out has elapsed.

When leaving *Eco* mode, the instrument therefore runs a *Turbo* cycle to allow the product temperature to be restored, after which it reverts to *Normal* mode and so on.

When *Turbo* mode is ON, this is indicated by the characters trb shown on the display alternated with the normal display. The *Normal* **SP** Set Point can be set between the values stored for $S.LS$ and $S.HS$ parameters ($S.LS < SP < S.HS$), *Eco* Set Point **SPE** can be set between the values of **SP** and $S.HS$ ($SP < SPE < S.HS$) and the *Turbo* Set Point **SPH** can be set between the values of $S.LS$ and **SP** ($S.LS < SPH < SP$).

Note: In the examples that follow, the Set Point is generically indicated as **SP** and the hysteresis as $r.d$, however, operationally, the instrument will act on the basis of the **Set Point** and of the **hysteresis selected as active**.

5.3 Measure inputs and display configuration

All parameters concerning measuring inputs are contained in the JIn group.

With $i.SE$ parameter it is possible to select the type of probe connected to the instrument. Admitted types: thermistors PTC KTY81-121 (**Pt**), NTC 103AT-2 (**nt**) or Pt1000 (**P1**).

With $i.up$ parameter it is possible to select the temperature measurement unit and resolution (**C0** = °C/1°; **C1** = °C/0.1°; **F0** = °F/1°; **F1** = °F/0.1°).

The instrument allows the measuring to be calibrated, that can be used for re-calibrating the instrument according to application needs, through parameters $i.C1$ (for **Pr1** input), $i.C2$ (for **Pr2**), $i.C3$ (for **Pr3**) and $i.C4$ (for **Pr4**).

The usage of **Pr2**, **Pr3** and **Pr4** probes is defined by parameters $i.P2$, $i.P3$ and $i.P4$. These can be configured for the following functions:

- EP **Evaporator Probe:** used to manage the defrost and the evaporator fans (see the relative paragraph);
- Au **Auxiliary Probe:** can be used as a display-only probe but it is also possible to assign it temperature alarms (possible usages: product, antifreeze probe, etc.);

- cd **Condenser Probe:** can be used as a display-only probe but it is also possible to assign it temperature alarms in order to signal condenser malfunctions alarms (e.g. dirty/clogged condenser);
- 2E **Evaporator Probe 2:** The probe performs the functions described later for controlling defrosts in the second evaporator of twin-evaporator plants;
- dG **Digital input** (see the Digital inputs functions);
- oF **Input not used**, when **Pr2** and/or **Pr3** and/or **Pr4** is/are not used, set $i.P2$, $i.P3$, $i.P4$ to **oF**.

It is not possible to program more inputs for the same function (priority goes to lowest number input).

With $i.Ft$ parameter it is possible to set a software filter related to the input value measurement in order to decrease the sensibility to rapid temperature variations (increasing the time).

With $i.ds$ parameter it is possible to establish what is normally shown on the display:

- P1 **Pr1** probe measurement;
- P2 **Pr2** probe measurement;
- P3 **Pr3** probe measurement;
- P4 **Pr4** probe measurement;
- SP **Active Set Point**;
- Ec The **Pr1** probe measurement in normal mode and the label **Eco** when in *Eco* mode;
- oF Display switched OFF.

With $i.CU$ parameter it is possible to program a measure offset that is applied only to the temperature shown on the display when $i.ds = P1, P2, P3, P4, Ec$ (not to the control). The corrections to the probe measurements applied to the control procedure are those of calibration parameters. Regardless of what has been set at $i.ds$ parameter, it is possible to view all the measurement variables by cyclically pressing and releasing the \square key. The display will alternately show the code that identifies the variable (see below) and its value. The variables that can be displayed are:

- Pr1 + **Pr1** probe measure;
 - Pr2 + **Pr2** probe measure;
 - Pr3 + **Pr3** probe measure (oN/oF status if digital input);
 - Pr3 + **Pr3** probe measure (oN/oF status if digital input);
 - Lt + The lowest temperature measured by **Pr1** probe;
 - Ht + The highest temperature measured by **Pr1** probe.
- and, if the real time clock is enabled:

- h. + 2 digits for the actual hour;
- n. + 2 digits for the actual minutes;
- d. + 2 digits for the actual day;

When the instrument is switched OFF, **Pr1** peak values are **always reset**. It is also possible to manually reset these values pressing the key ∇ for 3 s during peak visualization. The display will show "----" and peak memory will be reset. The instrument automatically exits the display variable mode 15 seconds after the last pressure on the \square key.

Please remember that **Pr1** probe data visualisation can be changed by the defrost display lock function (parameter $d.dL$ see the **Defrost** function).

5.4 Digital Inputs

All parameters concerning the Digital Inputs are contained in the JIn group.

The instrument has 2 voltage-free digital inputs whose function are defined by parameters $i.1F$ and $i.2F$ and whose action can be delayed by the time period set with parameters

i.1t and i.2t.

In addition, the instrument may have 2 further voltage-free digital inputs as an alternative to the measurement inputs **Pr3** and **Pr4**. In order to use these inputs digitally, the user must set the relevant parameters i.P3 and/or i.P4 = **dG**. The function performed by these digitally configured inputs is defined by parameters i.3F and i.4F while **their action is instantaneous and cannot be delayed**.

The parameters i.1F, i.2F, i.3F, i.4F can be configured for the following functions:

- 0 No function;
- 1 Cell door opening sensor with NO contact: at input closure the instrument alternately displays oP and the variable set at i.dS parameter. This Digital Input function starts also the timer set with parameter A.oA elapsed which the Open Door Alarm is activated. In addition, at door opening, the controller returns to *Normal* mode if it was in *Eco* mode and the *Eco* mode had been activated by i.Et parameter;
- 2 Cell door opening sensor with fan stop with NO contact: Similar to i.oF = 1, but with fans stop function. Once elapsed the A.oA interval the controller activates the *Door open Alarm* and restarts the fans.
- 3 Cell door opening sensor with compressor and fan stop with NO contact: Similar to i.oF = 2, but with compressor stop. Once elapsed the A.oA interval the controller activates the *Door open Alarm* and restarts the fans and the compressor;
- 4 External alarm signal with NO contact: at input closure the alarm is activated and the instrument alternately shows AL and the variable set at parameter i.dS.
- 5 External alarm signal with all control outputs disabled with NO contact: at input closure the alarm is activated, all the control output are disabled and the instrument alternately shows AL and the variable set at parameter i.dS;
- 6 *Normal/Eco* mode selection with NO contact: at input closure the *Eco* mode is activated. When instead the contact is open *Normal* mode is activate.
- 7 Instrument ON/OFF (stand-by) selection with NO contact: at input closure the instrument is switched ON while it is placed in Stand-by mode when the digital input is open;
- 8 *Turbo* activation command with NO contact: at input closure the instrument starts a *Turbo* cycle;
- 9 **AUX** auxiliary output remote command of with NO contact: at input closure the instrument activates the auxiliary output as described in the o.Fo = 2 operating mode of the auxiliary output.
- 10 Disable recording of **HACCP** alarms with NO contact: at input closure the instrument disables the recording of HACCP alarms;
- 11 Reset recording of **HACCP** alarms with NO contact: at input closure the instrument deletes all recorded HACCP alarms.
- 12 External PrA alarm signal and ot output disabled by NO contact: at input closure the instrument deactivates the output configured as ot and activates the alarm, the instrument display shows PrA alternated with the variable defined at i.dS parameter;
- 13 External HP alarm signal and ot output disabled by NO contact: at input closure the instrument deactivates the output configured as ot and activates the alarm, the instrument display shows HP alternating with the variable defined at i.dS parameter.
- 14 External LP alarm signal and ot output disabled by NO contact: at input closure the instrument deactivates the

output configured as ot and activates the alarm, the instrument display shows LP alternated with the variable defined at i.dS parameter.

- 15 Forcing a programmed Switch-ON/Switch-OFF (Stand-by) event with NO contact: the input closure of at least 1 s switches the instrument from the ON to the Stand-by state and vice-versa, until the next event. Therefore, if switch-on/stand-by events are programmed using the clock, this operation mode forces the state until the next event.
- 16 Defrost activation command with NO contact: at input closure the instrument starts a defrost cycle;
- 17 End-Defrost command with NO contact: at input closure if the defrost cycle is in progress the instrument stops it, otherwise inhibits the defrost start;
- 18 *Turbo* cycle command with NO contact and mono-stable command: at input closure the instrument starts a *Turbo* cycle. *Turbo* mode remains active since the Digital Input remains active and the r.tc time is elapsed. If the contact is opened during r.tc time counting, the *Turbo* cycle is interrupted. Elapsed the r.tc time count, in order to start a new *Turbo* cycle it is necessary de-activate then re-activate the Digital Input.
- 19 Inhibition of events programmed by clock.

-1, -2, -3 etc.

Features identical to the above but obtained through a **NC contact** and a **reversed logic operation**.

Note: Where multiple digital inputs are configured for the same function, the instrument will treat the contacts as if they were parallel (and consequently regard the result as an **OR** function).

5.5 Outputs and buzzer configuration

All parameters concerning the outputs configuration are contained in the JOu group.

The instrument outputs can be configured using parameters o.o1, o.o2, o.o3, o.o4.

The outputs can be configured for the following functions:

- ot Controls the compressor or however, the temperature control device;
- dF Controls the first defrost device;
- Fn Controls the evaporator fans;
- Au Controls the auxiliary device;
- At Controls a silenceable alarm device through a contact that is normally open and then closed when in alarm;
- AL Controls an alarm that cannot be silenced through a contact that is normally open and closed when in alarm;
- An Controls an alarm with a memory function through a contact that is normally open and closed when in alarm.
- t Control a silenceable alarm device through a contact that is normally closed and then open when in alarm;
- L Control an alarm that cannot be silenced through a contact that is normally closed and open when in alarm;
- n Control an alarm with a memory function through a contact that is normally closed and open when in alarm;
- on For controlling a device that must be active when the instrument is ON. The output is therefore disabled when the instrument is not powered or is in stand-by. This mode of operation can be used as a lighting control for the showcase, anti-fog heaters or other utilities;
- HE For controlling the heating device in neutral zone control mode (r.HC = nr);
- 2d Controls the second defrost device;

- L1 Shop light output managed by *Normal/Eco* mode. The output is ON in *Normal* mode and OFF in *Eco* mode operation.
- L2 Cell internal light output managed by digital input. The output is always OFF, it turns ON only from digital input configured as door opening ($i.d = 1, 2, 3$);
- oF No function (Output disabled).

When the outputs are deactivated ($o.oD = oF$), they can be controlled from the serial port at the following addresses:

Hex. Address	Description	Output status
28E	Enable/Disable OUT1 when $o.o1 = oF$	0 = Disable output; 1 = Enable output.
28F	Enable/Disable OUT2 when $o.o2 = oF$	0 = Disable output; 1 = Enable output.
290	Enable/Disable OUT3 when $o.o3 = oF$	0 = Disable output; 1 = Enable output.
291	Enable/Disable OUT4 when $o.o4 = oF$	0 = Disable output; 1 = Enable output.

If one of the outputs is configured as Auxiliary ($o.o\Box = Au$) its function is defined by the parameter $o.Fo$ and the function is conditioned by the time set at parameter $o.tu$.

The parameter $o.Fo$ can be configured for:

oF Auxiliary output not active;

- Control output with delayed activation: the auxiliary output is activated after $o.tu$ delay time from **ot** output activation; the auxiliary output is then turned OFF when **ot** is disabled. This working mode can be used as a command for a second compressor or other utilities with the same **ot** output conditions, but which must be delayed after the compressor start up to avoid excessive current absorption;
- Output activated by front key (\square/\square or ∇/AUX), Digital Input or Real Time Clock: the output is activated by pressing a key (\square or ∇) when suitably configured ($t.UF$ or $t.Fb = 1$) or by a digital input command if configured ($i.DF = 9$) or by an RTC event. The commands by key or digital input have a bi-stable (toggle) function. Bi-stable means that the 1st command turns ON the output, while the 2nd turns the output OFF. In this mode, the **AUX** output can be turned OFF automatically after the time set at $o.tu$ parameter. When $o.tu = oF$ the output is activated and disabled only manually using a key (\square or ∇), Digital Input or RTC ON/OFF event, otherwise, the output, once activated, is turned OFF automatically after the $o.tu$ time. This function can be used to manage, for example, the cell light, anti-fog resistances or other utilities. If **AUX** output ON/OFF events are programmed by Real Time Clock, the action of the keys or Digital Input (in this **AUX** output mode) forces output status until the next event.
- Intake** solenoid valve output. The output is used to control the **Hot-Gas intake valve** in centralized systems ($d.dt = HG$) defrost mode. The output configured in this way is permanently activated during the temperature control operation, while it is disabled during defrost and post-defrost to avoid the introduction of hot gas into the intake line.

The internal buzzer can be configured with parameter $o.bu$ for the following functions:

oF Buzzer always disabled;

- The buzzer is activated only to signal alarms;
- The buzzer is activated briefly only to signal the keys pressure (it does not signal alarms);
- The buzzer is activated both to signal the alarms and the keys pressure.

5.6 Temperature control

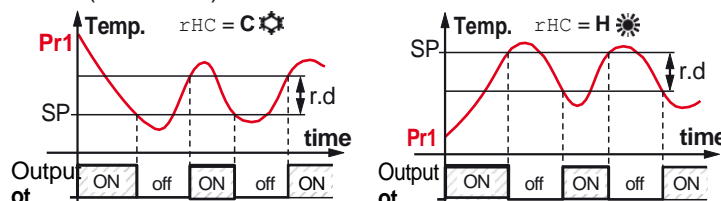
All parameters concerning the Temperature control functions can be found in the $j.re$ group.

The instrument control method is of **ON/OFF** type and acts on the outputs programmed as **ot** and **HE** in response to: **Pr1** probe measurement, Set Point(s) **SP** (or **SPE** and/or **SPH**) value(s), Intervention differential $r.d$ (or $r.Ed$ and/or $r.Hd$) value and **r.HC** the operating mode.

Via the parameter $r.HC$ the following functions can be obtained:

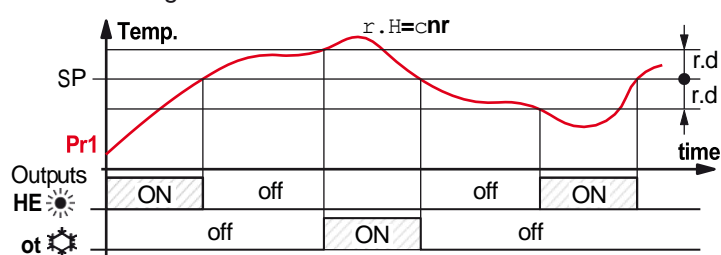
C Cooling or H Heating

Depending on the function mode programmed with parameter $r.HC$ the differential is automatically considered by the controller with positive values for **Cooling** control ($r.HC = C$) or negative values for **Heating** control ($r.HC = H$).



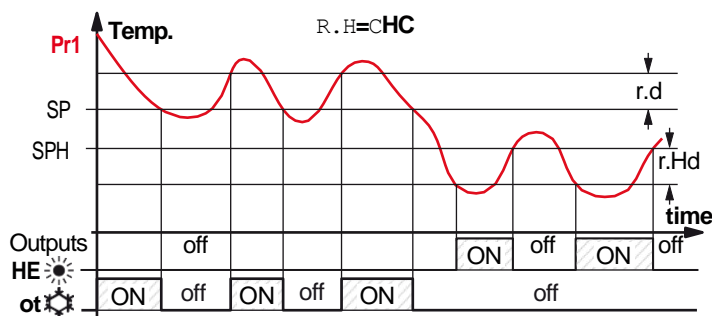
nr Neutral Zone or Cooling and Heating a single Set Point

When $r.HC = nr$, the output configured as **ot** operates with a Cooling action (like $r.HC = C$) while the output configured as **HE** operates with a heating action; both the actions use the active Set Point (**SP/SPE/SPH**). The intervention differential ($r.d/r.Ed/r.Hd$) is automatically assumed by the controller to have positive values for the Cooling action and negative values for the Heating action.



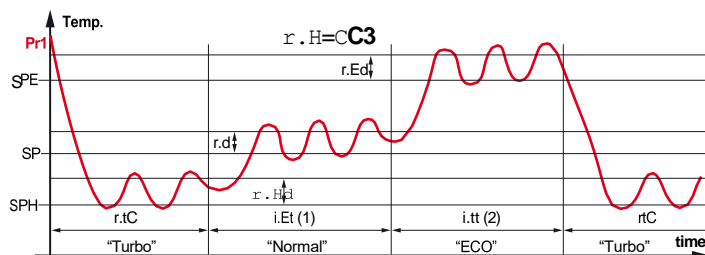
HC Cooling and Heating with two independent Set Points

As in the previous case, when $r.HC = HC$ the output configured as **ot** operates with Cooling action (like $r.HC = C$) while the output configured as **HE** operates with Heating action. In this case, however, the Set Point for the **ot** output is the active one (**SP/SPE/SPH**) while for **HE** output the Set Point is **SPH**. The intervention differential for **ot** output is the active differential ($r.d/r.Ed/r.Hd$) and is automatically assumed by the controller to have positive values for the Cooling action while for the output **HE** the differential is $r.Hd$ considered with negative values as for the Heating actions. In this mode, the activation of the *Turbo* cycle causes the instrument to operate with Neutral Zone and **SPH** Set Point.



C3 Cooling with three automatic modes

The instrument still operates with Cooling action, but this selection activates automatic switching between the three modes: *Normal*, *Eco* and *Turbo* as already described in the section on operating modes.



The time protections described in the next paragraph (PP1/PP2/PP3) always work on the output configured as **ot**.

In the event of a probe error, it is possible to set the instrument so that the **ot** output continues working in cycles according to the times programmed with parameters $r.t1$ (activation time) and $r.t2$ (deactivation time). If a **Pr1** probe error occurs, the instrument continues activating **ot** output for $r.t1$ time then disabling it for $r.t2$ time and so on until the error persists. By programming $r.t1 = \text{OFF}$ the **ot** output in probe error condition remains OFF. On the other hand, programming $r.t1$ to any value and $r.t2 = \text{OFF}$ the **ot** output, in probe error condition, remains always ON.

Remember that the operation of the temperature controller can be conditioned by the following functions: *Compressor protection function and power-ON delay*, *Defrost*, *Open door* and *External alarm with output disable* from Digital Input.

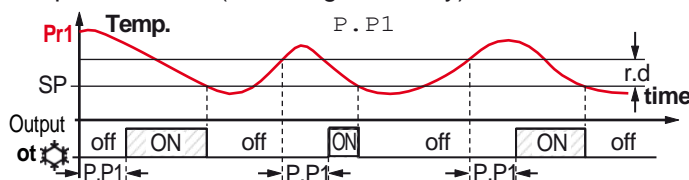
5.7 Compressor protection function and power-ON delay

All parameters concerning the compressor protection functions can be found in the jpr group.

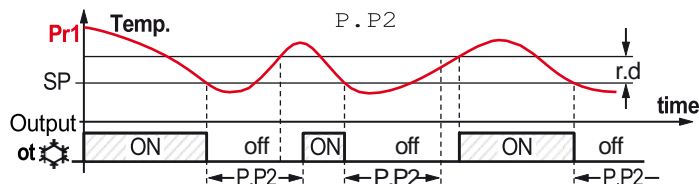
The “Compressor Protection” function aims to avoid repeated compressor start-ups controlled by the instrument in Cooling applications or otherwise can be used to add a timed control on the actuator control output.

This function foresees 3 time controls on the switching ON of the output configured as **ot** associated to the temperature control request. The protection consists in preventing the **ot** output being switched ON during the times set with parameters $P.P1$, $P.P2$ and $P.P3$ and therefore that any activation occurs only upon expiry of all protection times.

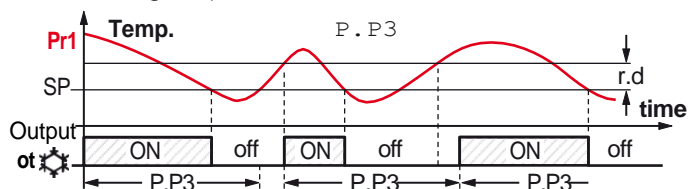
1. First control (parameter $P.P1$) foresees a delay to **ot** output activation (switching-ON delay).



2. Second control (parameter $P.P2$) foresees an inhibition to the activation of the output by a time delay that starts when the output is turned OFF (delay after switching-OFF).



3. Third control (parameter $P.P3$) foresees an inhibition to the activation of the output by a time delay that starts when the output was turned ON last time (delay between two switching-ON).



During the inhibition phases caused by the protections, the LED that points out the control output activation (**Cool** or **Heat**) blinks.

It is also possible to prevent the activation of all the outputs after the instrument is turned ON for the time set at parameter $P.od$ (Power ON delay).

During the power ON delay phase, the display shows the indication **od** alternated with the normal display.

These functions are disabled when all the relative parameters are set to **OFF** ($P.P1$, $P.P2$, $P.P3$ and $P.od = \text{OFF}$).

In case **HOT-GAS** defrost mode for centralized systems ($d.dt = \text{HG}$), the parameters $P.P1$ and $P.P2$ are used to set the **Liquid solenoid valve activation delay** and the **Aspiration solenoid valve deactivation delay** (see “HOT-GAS defrost operation for centralized systems”).

5.8 Defrost control

All parameters concerning the defrost control are contained in the jdf group.

The defrost control acts on the outputs configured as **ot**, **DF** and **dH**.

The type of defrost is set by the parameter $d.dt$:

EL With electrical heating (or by compressor stop):

during defrost, the **ot** output is disabled while the output **dF** is enabled. If the **dF** output is not used, the defrost will take place by compressor stop;

in With hot gas or Inversion of cycle:

during defrost both the outputs (**ot** and **dF**) are enabled;

no Without compressor output conditioning:

while defrosting, the **ot** output continues to operate in order to control the temperature, also **dF** output is enabled.

Et With electrical heating and defrosting temperature control: while defrosting, the **ot** output is disabled while the output **dF** operates as evaporator tempera-

ture control. In this mode the defrost duration is by $d.tE$ time-out. During defrost the **dF** output behaves as an heating action temperature control with Set Point = $d.tE$, the differential fixed to 1°C and refers to the temperature measured by the evaporator probe (**EP**). In this mode, if the evaporator probe is not enabled or in error, the defrost action behaves as with **EL** selection (therefore the **dF** output during defrost must always remain activated).

HG **With hot gas in centralized systems**: with this mode it is necessary to **configure 3 outputs** to control **Liquid solenoid valve** (**ot** output), **Hot gas solenoid valve** (**dF** output) and **Suction solenoid valve** (**Au** output with configuration $F_0 = 3$). During defrost, only the **dF** output is activated, while before and after defrost the valves perform a sequence of timed operations described below.

5.8.1 Starting automatic defrosts

The automatic control of defrost occurs:

- Defrost at defined times – “Real Time Clock Defrost” (when present and enabled the RTC);
- By interval times (regular or dynamic);
- By Evaporator temperature;
- By continuous compressor running time.

In order to avoid unnecessary defrosts when the evaporator temperature is high, the $d.tS$ parameter allows to set the temperature related to the evaporator probe (probe configured as **EP**) under which defrosts are possible.

If the temperature measured by the **EP** probe is higher than that at parameter $d.tS$ the defrosts are inhibited.

Defrosting at defined times – “Real Time Clock Defrosts”

The choice $d.dC = cL$ disables the defrost at specified intervals (parameters $d.di$ and $d.Sd$) and enables the Real Time Clock Defrosts programmed through parameters $c.01, c.02, c.03, c.04, c.05, c.06, c.07, c.08, c.09, c.10, c.11, c.12, c.13$ and, $c.14$. In this mode the instrument can therefore manage up to a maximum of 14 daily defrost events ($14 \times 7 = 98$ weekly defrosts with $d.8$).

In any case, the events can be programmed as desired even daily according to the following settings:

- $d.1$ = Monday ÷ $d.7$ = Sunday;
- $d.8$ Every day;
- $d.9$ Monday, Tuesday, Wednesday, Thursday, Friday;
- $d.10$ Monday, Tuesday, Wednesday, Thursday, Friday, Saturday;
- $d.11$ Saturday and Sunday;
- $d.oF$ No day (event disabled).

These options allow to manage the start of defrosts at different hours for weekdays and holidays according to user needs. For further detailed information and programming examples, see the “*Programmable events*” paragraph.

Note: Remember that for “*Real Time Clock Defrosts*” the user must set $d.dC = cL$ and the internal clock must be present and enabled.

Defrost by regular interval time

As an alternative to programmable timed defrosts, the instrument allows the execution of interval defrosts.

Through parameter $d.dC$ it is possible to establish the counting methods of the defrosting interval $d.di$:

- rt Intervals with counting of the total functioning time. The $d.di$ interval is counted as the total time the instrument is powered ON. This mode the one currently used in the refrigerators systems;

- ct Intervals with counting of the compressor functioning time (**ot** output switched ON). The $d.di$ interval is counted as the sum of the operating times of the control output (**ot** output activated). This mode is typically used in the positive temperature refrigerator systems with defrost by compressor stop.
- cS Defrost at all compressor stops. The instrument carries out a defrost cycle at each compressor stop (i.e. at each deactivation of the **ot** output) or however at $d.di$ defrost interval end. If $d.di = oF$ the defrost happens only when the compressor stops. This mode is used only on particular refrigerator systems in which the maximum evaporator efficiency conditions at each compressor cycle are requested.

To enable the automatic defrost at intervals, after setting $d.dC$ parameter as desired (**rt**, **ct** or **cS**), with parameter $d.di$ select the time interval between the end of a defrost and the beginning of the next.

The time that the instrument must wait to perform the first defrost after power ON can be set with parameter $d.Sd$. $d.Sd$ allows to perform the first defrost to a different interval from $d.di$ time.

To force the instrument to perform a defrost cycle at each power ON (as long as the conditions set with parameters $d.tS$ and $d.tE$ are satisfied) set parameter $d.Sd = oF$.

This allows the evaporator to be permanently defrost, even when frequent interruptions to power supply occur that may cause the cancellation of the various defrosting cycles.

If instead it is desired that all the defrosts are performed at the same interval time, set $d.Sd = d.di$.

Setting $d.di = oF$ the Automatic defrost function by interval is totally disabled (including the first, regardless to the time set at the $d.Sd$ parameter).

Dynamic Defrost Intervals System

Note: For this function is necessary to use the evaporator probe. Program $d.dC = rt, ct$ or **cS** and set $d.dd = \text{any value}$ to enable the Dynamic Defrost Intervals System mode.

If $d.dd = 0$ the defrost intervals are those set and the Dynamic Defrost Intervals System mode is disabled.

This mode allows to dynamically reduce the defrost interval counting ($d.di$ or $d.Sd$ if is the first defrost), anticipating, when necessary, the defrost execution, all based on an algorithm that detects a drop in the refrigerator thermal exchange performance. The dynamic defrost algorithm allows to highlight the heat exchange reductions by evaluating the current temperature difference between the 2 probes (**Pr1** and **EP**) and the same difference stored in proximity of the control Set Point temperature.

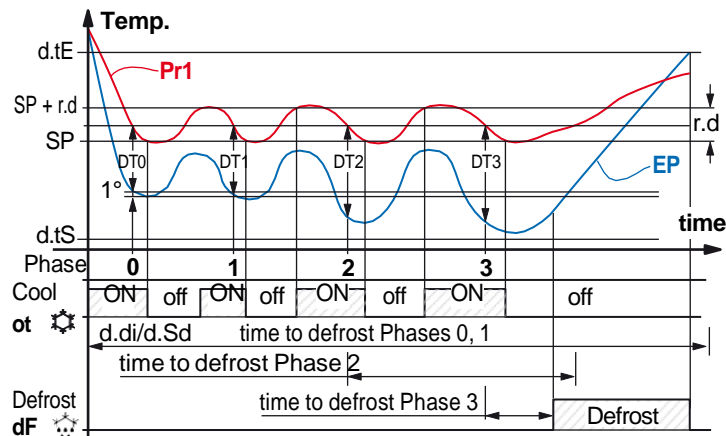
The advantage of the *Dynamic Defrost Interval* is the possibility to program a defrost interval time longer than normal. In this way, when necessary, the instrument has the possibility to anticipate/posticipate the defrost cycle from the programmed time.

If the system results correctly set, it is possible to avoid many unnecessary defrost cycles (and therefore obtain a consistent energy saving) that may occur with normal operation when, to ensure more system efficiency, the defrosts interval is programmed with a time that is often too short.

With parameter $d.dd$ - **Defrost interval percentage reduction** - is possible to establish the percentage of reduction of the remaining time to start next defrost when the conditions for the reduction happen.

If parameter $d.dd = 100\%$, at first increasing ($> 1^\circ$) of the ΔT

between cell (**Pr1**) and evaporator (**EP**) probes from the $\downarrow T$ stored value, the instrument starts immediately a defrost. To function correctly the instrument needs a $\downarrow T$ reference value, but, as all variations (Active Set Point, $r.d$ differential or the execution of a defrost cycle) delete the $\downarrow T$ reference value, often no reduction can be made until a new reference value has been acquired (at the end of the next defrost).



E.g. "Dynamic defrost intervals system" with a reduction $d.dd = 40\%$ and temperature defrost end.

Defrost by evaporator temperature

The instrument starts a defrost cycle when the evaporator temperature (**EP** probe) falls below the $d.tF$ programmed temperature for $d.St$ programmed time to ensure a defrost if the evaporator reaches very low temperatures which, as a rule, are symptomatic of a bad heat exchange compared to normal operating conditions.

If $d.tF = -99.9$ the function is disabled.

The function is operative both in the case of operation with defrosts at fixed times ($d.dC = cL$) and in the case of operation with interval defrosts ($d.dC = rt, ct, cS$).

Defrost by continuous compressor running time

The instrument starts a defrost cycle when the compressor is turned continuously ON for the time $d.cd$.

This function is used because the continuous compressor operation for an extended period is usually symptomatic of a bad thermal exchange typically caused by frost on the evaporator.

If $d.cd = oF$ the function is disabled.

The function is operative both in the case of operation with defrosts at fixed times ($d.dC = cL$) and in the case of operation with interval defrosts ($d.dC = rt, ct, cS$).

5.8.2 Manual defrost

To manual start a defrost cycle, press the key and keep it pressed for about 5 s while the instrument is in normal mode. After the key pressure, if the conditions are correct, the LED lights up and the instrument performs a defrost cycle.

To stop a defrost cycle, press the key and keep it pressed for about 5 s during the defrost cycle execution.

5.8.3 Defrost ends

With 1 evaporator

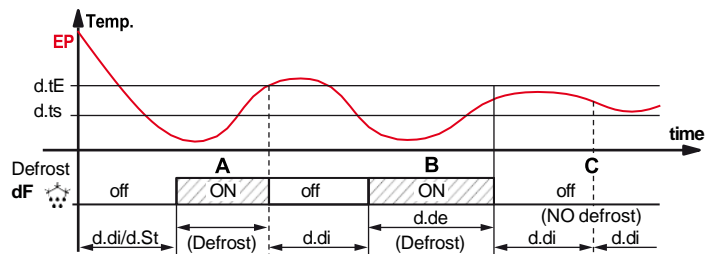
The automatic defrost cycle can be ended by time or, if an evaporator probe is used (**Pr2** probe configurade as **EP**), when the evaporator reaches a particular temperature.

If the evaporator probe is not used the duration cycle is set by the parameter $d.dE$. Setting $d.dE = 0$ interval or manual defrosts are disabled

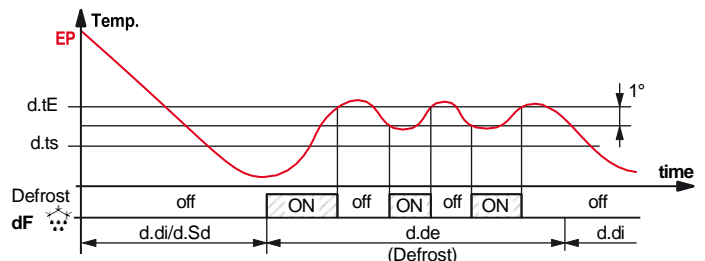
If instead the evaporator probe is used, the defrost cycle

ends when the temperature measured by the evaporator probe (**EP**) exceeds the temperature set at parameter $d.tE$. If $d.tE$ temperature is not reached, the defrost cycle is interrupted when the time set at the parameter $d.dE$ has elapsed. In order to avoid unnecessary defrosts when the evaporator temperature is high, in $d.dC = rt, ct, cS$ modes the $d.tS$ parameter allows to establish the temperature referred to the evaporator probe below which defrosts are possible.

If the temperature measured by the dvaporator probe is higher than the temperature set at parameter $d.tS$ and also t parameter $d.tE$ defrosts are inhibited.



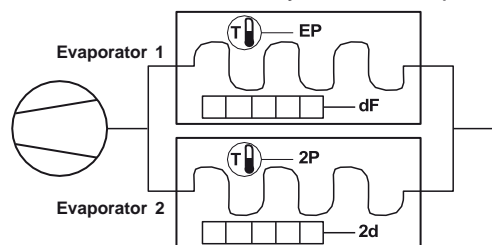
E.g.: Defrost **A** ends due to reaching of temperature $d.tE$, defrost **B** ends at the end of the $d.dE$ time as the temperature $d.tE$ is not reached, defrost **C** does not take place as the temperature is higher than $d.tS$.



E.g.: Electric defrost with evaporator temperature control: The defrost ends after the $d.dE$ programmed time. During defrost the **dF** output switches ON/OFF in heating mode with 1° differential (Hysteresis) in order to maintain the defrost temperature at $d.tE$ Set Point.

With 2 evaporators

The instrument can also be used to control defrosts in twin evaporators systems (or with a single evaporator, but large enough to require two defrost control areas) by means of two defrost outputs and two probe inputs for the two evaporators. Defrosts are always launched simultaneously for both evaporators and therefore the output configured as **2d** is always activated simultaneously with the output configured as **dF**.



E.g.: Schematic example of plant with two evaporators, 2 probes and electric defrosters.

If the two evaporator probes are not used, the defrost end, intended as deactivation of the defrost outputs, happens separately at the end of the times defined at parameters $d.dE$ (for output **dF** which controls evaporator 1 defroster) and $d.d2$ (for output **2d** which controls evaporator 2 defroster). However, the end of a defrost as a controller phase always occurs when both times have elapsed.

If each evaporator is equipped with its own probe, an input as evaporator probe 1 (i . PD = **EP**) and an input as evaporator probe 2 (i . PD = **2E**) must be configured.


In this case the instrument controls the defrosts using the following criteria:


- Defrost is enabled when at least one of the two temperature readings is below the temperature set at parameter d . tS;
- Defrost by temperature starts when at least one of the two Temperature readings remains below the temperature set at parameter d . tF for time d . St;
- Defrost end, in the sense of deactivation of the defroster command outputs **dF** and **2d** in modes d . dt = **EL**, **in** and **no** occurs separately for the two evaporators when their respective temperatures sensed by the probes rise above the values set at parameter d . tE (evaporator 1 with probe **EP**) and d . t2 (evaporator 2 with probe **2E**). If these temperatures are not reached within the times set at parameters d . dE and d . d2 their respective defrosting actions are interrupted. However, the end of defrost, as a controller phase, occurs when both readings exceed the intended values (or, if the temperatures are not reached, when their maximum durations have reached).

If the selected defrost mode is of the type employing electric heating and thermostating (d . dt = **Et**), the two defrost outputs **dF** e **2d** behave as temperature controllers with heating function with their own Set Point: d . tE (evaporator 1) and d . t2 (evaporator 2), both with hysteresis fixed at 1°C and with reference to the respective temperatures measured on the two evaporators.

If one of the two evaporator probes is not enabled or is in error, its defrost behaves as with selection **EL** (during defrost the defrost output remains always active).

Note: The “*Dynamic Defrost*” function and the thermostating function of the fans, always and only operate as a function of the probe configured as **EP** (evaporator 1). If the control with the twin evaporator is not used, it is recommended to set d . d2 = **oF** in order to avoid unwanted influences on total defrost duration.

The defrost cycle in progress is shown on the instrument with the lighting up of the  LED.

In order to allow evaporator dripping, at the end of the defrost is possible to delay the compressor (**ot** output) restart of the time set with parameter d . td. During this delay the  LED flashes to indicate the dripping in progress.

5.8.4 Defrosts in event of evaporator probe error

In event of evaporator probe error the defrosts occur at intervals d . Ei with duration d . EE.

In the event that a probe error occurs, when the time left to start or end of the defrost normally counted is less than that set for the parameters related to the probe error conditions, the defrost start or end occurs with the shortest time.

These functions are provided because, when the evaporator probe is used, the defrost duration is usually set longer than necessary (the time d . dE is a security time-out) and, in the case the “*Dynamic Intervals Defrost System*” is used, the interval is usually set longer than what is normally programmed into instruments that do not have these functions.

Note: In case of plants with double evaporator, the defrost duration switching function acts only on parameter d . dE relative to evaporator 1 (d . d2 remains at the same value even if the probe configured as **2P** is in error).

5.8.5 Defrost display lock

Through parameters d . dL and A . dA it is possible to define the display behaviour during defrost.

The d . dL parameter can assume the following values:

- on Locks the display on the last **Pr1** probe temperature readed for all the defrost cycle and until, after defrost end, the **Pr1** temperature has not reached the lock value or the value [SP + r . d] or is elapsed the time setted on parameter A . dA.
- Lb Shows the label **dEF** during the defrost cycle and of **PdF** after the defrost, until, at defrost end, the **Pr1** temperature has not reached the lock value or the value [SP + r . d] or is elapsed the time setted on parameter A . dA.
- oF The display continues showing the temperature measured by **Pr1** probe during the defrost cycle.

5.8.6 Pre- and post-defrost output

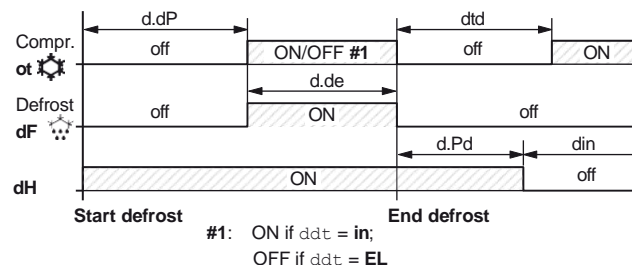
The configuration of the **dH** output (which can be used as a control of a drainage resistance that can be enabled before, during and after defrost) and the setting of the times d . dP and d . Pd allow to have an output signal before defrost and after the end of the defrost.

The pre-defrost and post-defrost output activation times are programmable with parameters d . dP and d . Pd.

The operation consists in deactivating the **ot** control output and activating the **dH** output when the defrost starts.

Then keep deactivated (if the defrost is electric) or reactivate (if the defrost is with hot gas/cycle inversion) the **ot** control output and activate the defrost output **dF** after the d . dP time. Then deactivate the defrost output **dF** and the control output **ot** when d . dE time has elapsed.

In the end keep the control output **ot** deactivated for the d . td time (dripping time) and deactivate the **dH** output when d . Pd time has elapsed.



5.8.7 Hot-gas defrost in centralized systems

The described operation is enabled setting d . dt = **HG**.

When using this defrost mode it is necessary to configure **3 outputs** to control:

- The *Liquid Solenoid Valve* (output **ot**);
- The *Hot Gas Solenoid Valve* (**dF** output);
- The *Suction Solenoid Valve* (**Au** output with o . Fo = **3** configuration).

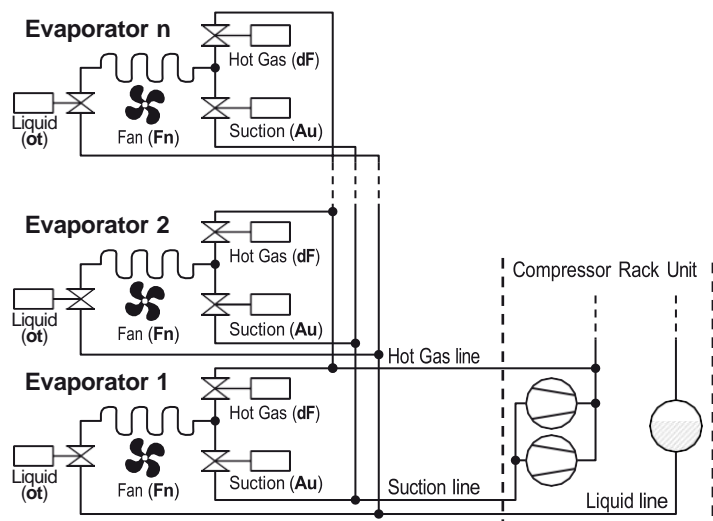
In this configuration, during defrost only the **dF** output is active, while before and after defrosting, the valves **ot** and **Au** perform a sequence of timed operations described below.

As in all Hot Gas defrosts, also these systems use the heat of the compressor exhaust gas to perform the defrost.

However, given the construction of these systems in which all the evaporators are mounted in parallel and the compressors, being centralized, are not controlled by the instrument (to adjust the temperature the instrument controls the *Liquid*

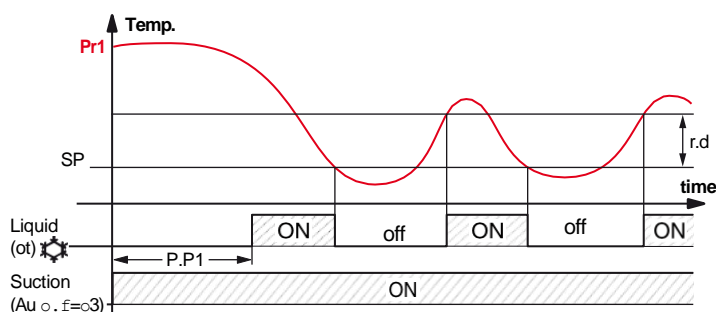
solenoid valve) it is necessary to use an output that controls an *Aspiration solenoid valve* so that the evaporator that performs the defrost is isolated from the system.

Similarly while defrosting, the *Liquid solenoid valve* (the same used to control the temperature) **must also be closed to isolate the evaporator**.



Note: For greater clarity in the diagram, some details concerning the hydraulic circuit have been deliberately omitted (non-return valves etc.) because they are not controlled by the instrument but are still necessary for the correct system operation.

To avoid sudden pressure changes in the plant, the defrost phases are performed respecting a precise sequence described below.



The system configured for the **Hot Gas defrost in centralized plants** behaves as follows:

- At start-up, the *Suction solenoid valve* is activated immediately (respecting, if set, the $P. od$ delay), after which, if there is a cooling request, also the *Liquid solenoid valve* is activated (respecting the $P. P1$ delay).

- During the control phase, the *Suction solenoid valve* is therefore always activated while the *Liquid valve* is activated as a function of the temperature control.

- When defrost occurs, first of all *Liquid valve* (ot output) is immediately disabled (if active);
- Then, after the delay set at parameter $P. P2$ the instrument also deactivates:
 - the *Suction valve* (output **Au** configured as $o. Fo = 3$) and, if parameter $F. FE = oF$,
 - the *Fans output* (**Fn** output).

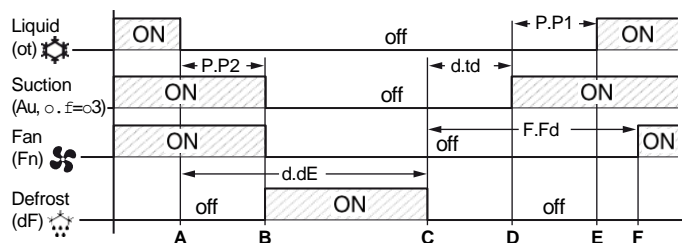
Note: During this period of time, the fans operation and maintaining the suction valve open are necessary to facilitate the complete evaporation of the fluid contained in the evaporator.

If the defrost request occurs when the *Liquid valve*

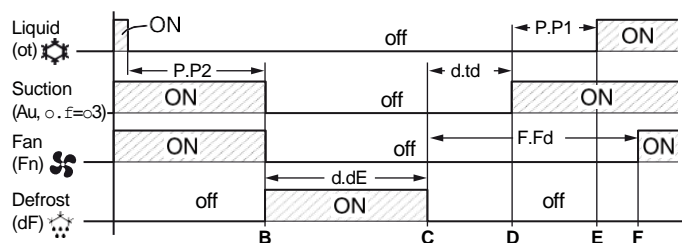
outlet is already closed and the time $P. P2$ has elapsed (which counting always starts when the **ot** output is turned OFF) the deactivation of the *Suction valve* and eventually of the fans is immediate.

Otherwise, the defrost request happens during the $P. P2$ time count, the *Suction valve* and the fans deactivation occurs at the when $P. P2$ counting expires. At this point the *Hot Gas valve* is activated (**dF** output) and the defrost begins;

- At defrost end (always handled by the $d. dE$ time or by the evaporator temperature $d. tE$ or by the manual control), the output **dF** is disabled and the delay times $d. td$ (dripping time) and $F. Fd$ are activated (fans delay after defrost);
- When $d. td$ time counting has elapsed, the output of the *Suction solenoid valve* is reactivated, as when the instrument is switched ON;
- In the event that, as often happens, the temperature controller should request it, after the $P. P1$ time the *Liquid valve* will be activated and the instrument returns to the normal temperature control mode;
- When $F. Fd$ time counting has elapsed, fans are re-activated if the evaporator temperature is lower than the one set at parameter $F. FL$;



Example of Hot Gas defrost for centralized systems with defrost start when the Liquid valve is open.



Example of Hot Gas defrost for centralized systems with defrost start when the Liquid valve is closed after the $P. P2$ time counting has expired.

5.9 Evaporator fans control

All parameters concerning evaporator fans control are contained in the group $]Fn$.

The fans control operates on the output configured as **Fn** depending on certain instrument control statuses and the temperature measured by the **EP** evaporator probe.

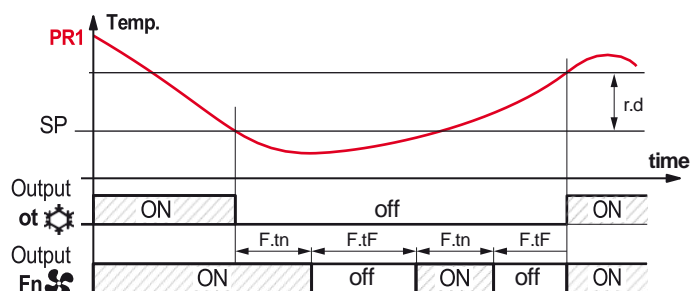
In the case that **EP** evaporator probe is not used or in error, the output **Fn** is activated only depending on the parameters $F. tn$, $F. tF$ and $F. FE$.

Parameters $F. tn$ and $F. tF$ decides the fans functioning when the output configured as **ot** (compressor) is OFF.

When output **ot** is OFF, it is possible to set the instrument so that the **Fn** output continues working in cycles according to the times programmed at the parameters $F. tn$ (fan activation time) and $F. tF$ (fan deactivation time).

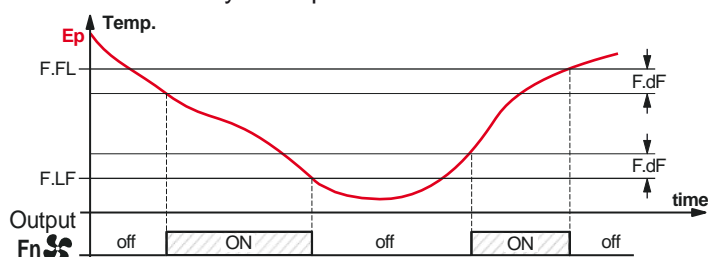
When **ot** output is switched OFF, the instrument activates the

F_n output for the time $F.tn$, then deactivates it for the time $F.tF$ and so on whilst **ot** output remains OFF.
 Setting $F.tn = \text{off}$ the **F_n** output will be disabled when the **ot** output is switched OFF (evaporator fans OFF when the compressor is OFF or fans run on compressor).
 Programming instead $F.tn$ to any value and $F.tF = \text{off}$ the output **F_n** will remain switched ON even when output **ot** is in OFF condition (evaporator fans ON with compressor OFF).



The parameter $F.FE$ instead decides whether the fans must always be switched ON independently of the defrost status ($F.FE = \text{on}$) or switched OFF during defrost ($F.FE = \text{off}$); in this later case, it is possible to delay the fans re-start even after the end of the defrost by the time set at parameter $F.Fd$. When this delay is active the **LED** flashes to signal the delay in progress.

When the evaporator probe is used the fans, as well as being conditioned by the parameters $F.tn$, $F.tF$ and $F.FE$, are also conditioned by a temperature control.



In fact it is possible to disable the fans when the temperature measured by **EP** evaporator probe is higher than the one set at parameter $F.FL$ (temperature too hot) or lower than the one set at parameter $F.LF$ (temperature too cold).

The relative differential that can be set at parameter $F.dF$ is also associated with these parameters.

Remember that the fans functioning can be conditioned by the "Door open" function controlled by digital input.

Note: Particular attention should be paid to the proper use of temperature-based fans control functions, as in a typical refrigeration application, the evaporator fan stop blocks the heat exchange.

5.10 Alarm functions

All parameters concerning the Alarm functions are contained in the group **Al**.

The alarm conditions of the instrument are:

- Probe errors: $E1$, $-E1$, $E2$, $-E2$, $E3$, $-E3$, $E4$, $-E4$;
- Temperature alarms: $H1$, $L1$, $H2$, $L2$;
- External alarm: AL , PrA , HP , LP ;
- Open door alarm: oP ;

The alarm functions act on LED **Δ**, on the internal buzzer (when present and configured with parameter $o.bu$) and on the output selected with parameters $o.o1$, $o.o2$, $o.o3$ and $o.o4$ according to the parameters set.

Alarm conditions are pointed out lighting up the **Δ** LED, while the acknowledged alarm is indicated by the flashing of **Δ** LED. The buzzer (when present) can be programmed to be activated when an alarm occurs ($o.bu = 1$ or 3) and can be disabled (alarm silencing) manually by pressing any of the instrument keys.

Also outputs can signal alarms; possible selections of output parameters for the alarm signalling function are:

- At** The output is to be activated in alarm condition and can be disabled manually by pressing any of the instrument keys (typical application for an acoustic signal);
- AL** The output is to be activated in alarm condition but cannot be manually disabled; it is then disabled only when the alarm status ceases (typical application for a light signal);
- an** The output is to be activated in alarm condition and must remain active even when the alarm status has ceased (latched alarm). The disabling action (recognition of a latched alarm) can only be carried out manually by pressing any key when the alarm status has removed.
- t** Function similar to **At** but with inverse logic function (output active in normal conditions, disabled in alarm).
- L** Function similar to **AL** but with inverse logic function (output active in normal conditions, disabled in alarm).
- n** Function is similar to **An** but with inverse logic function (output active in normal conditions, disabled in alarm).

5.10.1 Temperature alarms

The instrument has 2 temperature alarms, fully configurable with a maximum and a minimum threshold.

The temperature alarms work according to the probe measurements set at parameters $A.y1$ and $A.y2$, the alarm thresholds set with parameters $A.H1$ and $A.H2$ (max. alarms) and $A.L1$ and $A.L2$ (min. alarms) and the relative differentials $A.d2$ and $A.d2$. Using parameters $A.y1$ and $A.y2$ it is also possible to define whether the alarm thresholds $A.H1$, $A.H2$, $A.L1$, $A.L2$ are absolute or relative to the set point.

Depending on the desired alarm operating mode, parameter $A.y1$ and $A.y2$ can be set as:

- 1 Absolute alarms referred to **Pr1** with label (H – L) display;
- 2 Relative alarms referred to **Pr1** with label (H – L) display;
- 3 Absolute alarms referred to **Au** with label (H – L) display;
- 4 Relative alarms referred to **Au** with label (H – L) display;
- 5 Absolute alarms referred to **cd** with label (H – L) display;
- 6 Absolute alarms referred to **Pr1**, no label displayed;
- 7 Relative alarms referred to **Pr1**, no label displayed;
- 8 Absolute alarms referred to **Au**, no label displayed;
- 9 Relative alarms referred to **Au**, no label displayed;
- 10 Absolute alarms referred to **cd**, no label displayed;
- 11 Absolute alarms referred to **EP** with label (H – L) display;
- 12 Absolute alarms referred to **EP**, no label displayed.

Using some parameters it is also possible to delay the enabling and the intervention of these alarms. These parameters are:

- A.P1, A.P2** Temperature alarm intervention delay **at instrument power ON** when the instrument is in alarm status at power ON. If the instrument is not in alarm status at power ON, $A.P1$ and $A.P2$ are not considered.
- A.da** This is the time period during which temperature alarms 1 are disabled at the end of a defrost cycle.

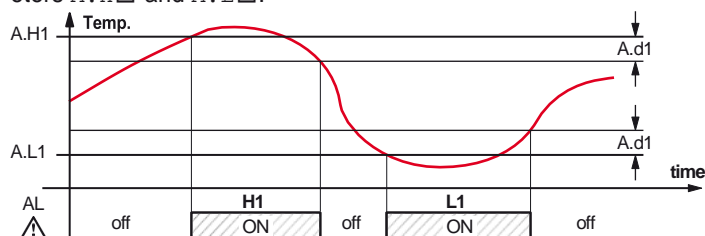
Note: During defrosts and after defrosts for the time set with $A.da$, alarm 1 is disabled, whereas during defrosts alarm 2 is always enabled.

A.t1, A.t2 Activation delay times for temperature alarms 1 and 2. Temperature alarms 1 and 2 are enabled at the end of the alarm-disabling time periods and activated after time periods A.t1 and A.t2 when the temperature measured by the probe configured for the alarm rises above or drops below the respective maximum and minimum alarm thresholds.

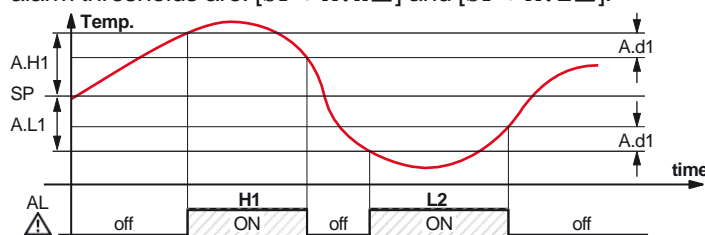
Through parameters A.A1 and A.A2 it is also possible to set the alarms action on control and on alarm outputs (buzzer included).

This means that, for example, is possible to intervene on the control output directly, by deactivating it in the case there are temperature alarms also on the probes configured as **Au** (e.g. *antifreeze* function) or as **CD** (e.g. *dirty condenser* function). Configuring both alarms with reference to the same probe, the instrument also allows to manage pre-alarm signals (for example that do not activate the alarm output and/or the buzzer) and alarm (which instead activate the alarm output and/or the buzzer).

If the alarms are *Absolute alarms* (A.□□ = 1, 3, 5, 7, 9, 10), the alarm thresholds are the same as those set at parameters A.H□ and A.L□.



If the alarms are *Relative alarms* (A.□□ = 2, 4, 6, 8), the alarm thresholds are: $[SP + A.H□]$ and $[SP + A.L□]$.



The maximum and minimum temperature alarms can be disabled by setting the related parameters A.H□ and A.L□ = oF. Triggering of the temperature alarms causes the Δ LED to light up, activates outputs configured with the set alarm function, and activates the internal buzzer if configured.

5.10.2 External alarms (digital inputs)

The instrument can notify alarms external to the instrument when one or more digital inputs configured as i.□F = 4, 5, 12, 13, 14 are activated.

Simultaneously to the configured alarm signal (buzzer and/or output), the instrument points out the alarm by lighting up the Δ LED and displaying the label of the alarm detected (AL, PrA, HP, LP) alternated to the variable set at parameter i.dS. The i.□F = 4 mode produces no action on the control outputs whereas the other modes deactivate the ot output or deactivate all control outputs at digital input intervention.

Alarm	ot output (compressor)	Other control outputs (Fn, dF, Au, HE)
AL (4)	Unchanged	
AL (5)	OFF	
PrA, HP, LP	OFF	Unchanged

5.10.3 Open door alarm

The instrument can point out an **Open door alarm** activated by the digital input with the function programmed as:

i.□F = 1, 2 or 3.

When the digital input is activated the instrument shows oP alternated to the variable set at parameter i.dS. Elapsed the delay programmed at parameter A.oA, the instrument signals the alarm activating the configured alarm output (buzzer/output), lighting up the Δ LED while continues displaying the label oP. At the intervention of the open door alarm the inhibited output are immediately reactivated (fans or fans + compressor).

5.11 HACCP function (alarm recording)

The parameters associated with displaying **HACCP** alarms are contained in the JHA group, while those associated with the configuration are contained in the JAL group.

The HACCP (*Hazard Analysis and Critical Control Points*) function causes the instrument to record the last 10 alarms that have occurred together with those information useful for determining the criticality of the alarm.

The function is available only for those instruments equipped with the calendar clock.

The following HACCP alarms can be stored in memory:

Alarm code HACCP	Alarm
H1	Maximum temperature alarm H1
L1	Minimum temperature alarm L1
H2	Maximum temperature alarm H2
L2	Minimum temperature alarm L2
bo	Power failure (black-out) alarm
AL	Alarm from digital input

HACCP alarms are stored if the correspondent enabling parameters are configured and the preset time configured at the same parameter has elapsed.

Furthermore, alarm recording can also be disabled through a configured digital input (i.□F = 13) or through the \oplus or ∇ keys, if appropriately configured (t.UF o t.Fb = 7).

To view these alarms, use the procedure for viewing the programming parameters to access the H.01 ÷ H.10 parameters contained in the JHA group.

Note: For details, please see: "2.9 Displaying haccp alarms (models with RTC)" a pagina 5.

The instrument automatically sorts these parameters from most recent (H.01) to oldest (H.10) whenever an alarm is recorded or deleted.

If more than 10 alarms occur, the instrument deletes the information about the oldest alarm by overwriting it with the one of most recent alarm.

When this occurs the instrument increments by one the value of the H.dL parameter by which it is possible to display the number of alarms the instrument has been forced to delete when these exceeded the permitted memory.

After selecting the parameter for the alarm which the user wishes to display, if the label flashes this indicates that the alarm has never been displayed (therefore not recognized/acknowledged). To recognise it, simply access the parameter pressing the \square key and display it.

The next time it is displayed, the parameter label will be shown solid (not flashing).

If the alarm is still active at the time it is displayed, the data are shown but the alarm is not recognized and cannot be cancelled. In the event of unrecognized (and therefore still ongoing)

HACCP alarms, the instrument displays the message **HAC** alternated with the *Normal display*.

Within the parameter the data will be displayed sequentially as the **[P]** key is repeatedly pressed.

The alarm can be deleted by holding down the **[H]** key for more than 5 s while one of the data of the alarm is displayed. Its deletion is confirmed by the display indicating “---” for approx. 1 s. Similarly the value of the **H.dL** parameter can be reset by holding down the **[V]** key for more than 5 seconds while its value is displayed.

However, if desired, all alarms can be deleted immediately by:

- Holding down the **[U]** key for 5 s if parameter **t.UF = 6**;
- Holding down the **[V]** key for 5 s if parameter **t.Fb = 6**;
- By a digital input if the relevant parameter **i.□F = 11**.
- By the “Reset all parameter function” (at **r.P** password prompt answer **-48**).

5.11.1 HACCP temperature alarms

Setting parameters **A.r1** (for alarms **H1** and **L1**) and **A.r2** (for alarms **H2** and **L2**) it is possible to enable recording of temperature alarms as HACCP alarms.

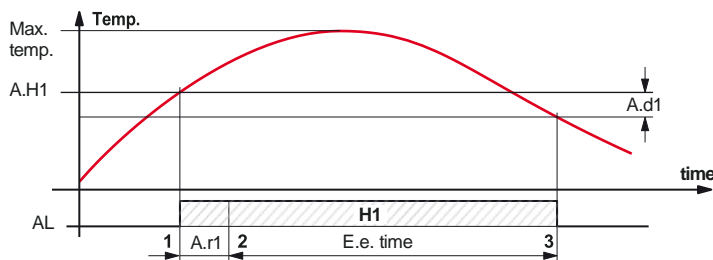
The same parameters can also be used to define the minimum alarm duration that will cause the alarm to be recorded as an HACCP alarm.

If the alarm duration is shorter than the programmed time, the alarm is not recorded.

Setting **A.r□ = oF**, recording is disabled.

For each recorded temperature alarm, the following data are stored:

- Alarm type (**A. = H1** or **L1** or **H2** or **L2**);
- HACCP alarm start time
(**y.** = year, **M.** = month, **d.** = day, **h.** = hour, **n.** = minute);
- HACCP alarm duration (**E.** = hours, **e.** = minutes);
- Critical temperature reached (max. peak if **Hi** alarm or min. peak if **Lo** alarm).



Example of HACCP maximum temperature alarm H1

1. Configured alarm start (in this case with **A.t1 = oF**);
2. HACCP alarm recording start;
3. Alarm end.

Note: If there is a power failure during a temperature alarm, the instrument records the duration of the alarm up until the moment the power failure began.

In order to capture correct information on the temperature conditions which the user wishes to monitor, it is recommended to set a black-out alarm and if necessary disable the on-startup alarm delays (**A.P□**) so that if the alarm is still active when the power returns it is recorded as a new alarm at the end of the power failure.

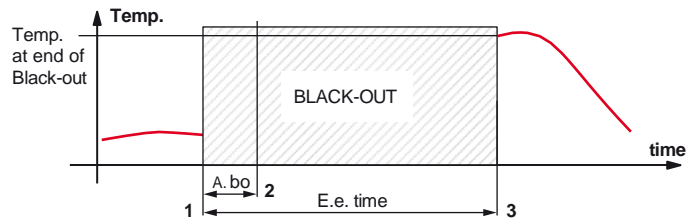
5.11.2 HACCP power failure alarms (black-out)

This type of alarm is recorded only if the power failure exceeds the value set at parameter **A.bo**.

If **A.bo = oF** the black-out alarm is never recorded.

For each black-out alarm, the following data are recorded:

- Alarm type (**A. = bo**);
- Start time
(**y.** = year, **M.** = month, **d.** = day, **h.** = hour, **n.** = minute);
- Black-out duration (**E.** = hours, **e.** = minutes);
- The temperature of alarm 1 probe (see parameter **A.y1**) measured at black-out end (if available; if not available the display shows “---”).



Example of HACCP black-out alarm

1. Power failure;
2. Min. power failure duration that will enable HACCP black-out alarm recording;
3. Return of power supply (alarm end).

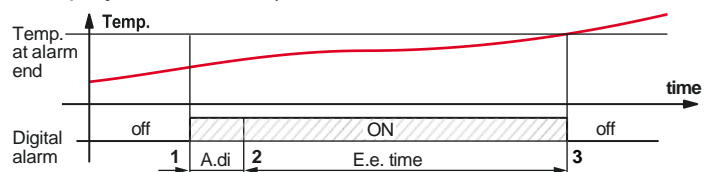
5.11.3 HACCP alarms from digital input

HACCP alarms from digital input are recorded only if the generic alarm (**AL**) from a digital input is configured in modes **4** or **5** and remains for a time longer than the time set in parameter **A.di**.

If **A.di = oF**, an alarm from a digital input is never recorded.

For each alarm from a digital input recorded, the following data are stored:

- Alarm type (**A. = AL**);
- Start time
(**y.** = year, **M.** = month, **d.** = day, **h.** = hour, **n.** = minute);
- Alarm duration (**E.** = hours, **e.** = minutes);
- The temperature of alarm 1 probe (see parameter **A.y1**) measured at alarm end (if available, if not available the display shows “---”).



Note: If the power fails during an alarm from a digital input, the instrument records the duration of the alarm up until the moment the power failure began.

5.12 Functioning of keys **[U]** and **[V]/Aux**

All the parameters concerning keyboard functions are contained in the group **JtS**.

Two of the instrument keys, in addition to their normal functions, can be configured to operate other commands.

The **[U]** key function can be defined by the parameter **t.UF** while the **[V]** key function can be defined by the parameter **t.Fb**.

Both the parameters have the same possibilities and can be configured for the following functions:

- oF** The key carries out no function;
- 1 Pressing the key for at least 1 s, it is possible to enable/disable the auxiliary output if configured (**o.Fo = 2**).
If are programmed activation/deactivation events of the auxiliary output by Real Time Clock the action of the keys force output status until the next event;

- 2 Pressing the key for at least 1 s, it is possible to toggle between Eco and Normal mode (**SP, SPE**). Once the selection has been made, the display shows the active Set Point code (**SP, Eco**) for about 1 s. If are programmed mode changes events by Real Time Clock the action of the keys force status until the next event.
- 3 Pressing the key for at least 1 s, it is possible to switch the instrument from ON to Stand-by status and vice-versa. If switch-ON/Stand-by events are programmed using the RTC, the key action has priority on the event.
- 4 Pressing the key for at least 1 s activates/deactivates a **Turbo** cycle.
- 5 Forces a programmed Switch-ON/Switch-OFF (Stand-by) event - Pressing the key for at least 1 s switches the instrument from the ON state to the Stand-by state and vice-versa, until the next event. Therefore, if switch-ON/Stand-by events are programmed using the RTC, the key action has priority on the event.
- 6 HACCP Alarm Reset - Pressing the key for at least 1 s resets stored HACCP alarms. The display confirms the reset showing "---" for about 1 s.
- 7 HACCP Alarm Recording Disabled - Pressing the key for at least 1 s disables/enables recording of the HACCP alarms. After the selection is made the display shows for about 1 s:
H_{On} (HACCP alarms enabled) or
H_{Of} (HACCP alarms disabled).

5.13 Clock programmable events

Programmable events are set using the **14 parameters**

(c.01... c.14) contained in the]cE group.

After selecting the desired parameter, press the [P] key repeatedly to cycle through the following:

- h. □□ Hours (e.g. h.13);
- n. □□ Minutes (e.g. n.45);
- d. □ Day of the week (e.g. d.1);
- t. □ Type of event to be performed at the programmed time (e.g. t.1).

Note: See "2.8 Scheduling events at defined times (models with RTC)" a pagina 4 for details.

The days are numbered as follows:

- d. 1 Monday ÷ d. 7 Sunday;
- d. 8 Every day;
- d. 9 Monday, Tuesday, Wednesday, Thursday, Friday;
- d.10 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday;
- d.11 Saturday and Sunday;
- d.oF No day (event disabled).

The 14 event-programming parameters allow a maximum of 14 x 7 = **98** weekly events to be scheduled (using d. 8).

The following events can be programmed:

- t.1 Switch instrument ON;
- t.2 Put instrument in Stand-by;
- t.3 Switch Auxiliary output ON;
- t.4 Switch Auxiliary output OFF;
- t.5 Start defrost (to enable scheduled defrosts, program also d.dC = cL);
- t.6 Switch to Eco mode (**SPE**);
- t.7 Switch to Normal mode (**SP**).

A manual intervention, e.g. to change the mode (Eco or Normal) or activate/deactivate the auxiliary output, is effective only until the next scheduled event.

For example, if the instrument is in Eco mode and is forced manually to Normal mode it will stay in Normal mode until the next event that switches it to Eco mode.

Programming example

The user wishes to set the following events:

- 4 daily defrosts weekdays at 7:00, 12:00, 17:00 and 22:00;
- 2 defrosts every Sunday at 7.00 and 19.00
(also set d.dC = cL);
- 1 daily weekday switching from Normal to Eco mode at 20.00 and 1 switching from Eco to Normal mode at 6.00;
- No switches on Sundays;
- 1 daily weekday switching Aux output ON at 8.00 and 1 daily switching the Aux output to OFF at 21.00;
- No switches on Sundays.

Event	Parameter	Hour	Minutes	Days	Event
Work day defrost 1	c.01	h.07	n.00	d.10	t.5
Work day defrost 2	c.02	h.12	n.00	d.10	t.5
Work day defrost 3	c.03	h.17	n.00	d.10	t.5
Work day defrost 4	c.04	h.22	n.00	d.10	t.5
Sunday defrost 1	c.05	h.07	n.00	d.7	t.5
Sunday defrost 2	c.06	h.19	n.00	d.7	t.5
ECO mode	c.07	h.20	n.00	d.10	t.6
Nomal mode	c.08	h.06	n.00	d.10	t.7
Aux on	c.09	h.08	n.00	d.10	t.3
Aux off	c.10	h.21	n.00	d.10	t.4
	c.11. c.14	h.00	n.00	d.oF	t.oF

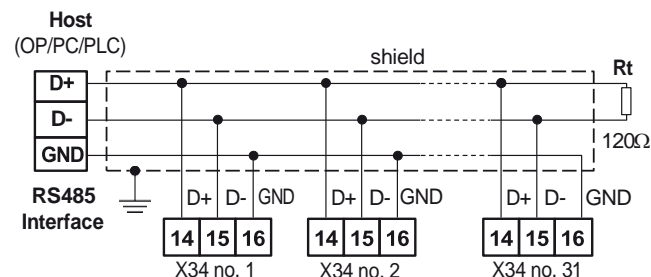
5.14 RS485 Serial Interface

The instrument can be equipped with a **RS485** serial communications interface, by means of which it is possible to connect the controller to a network to which other instruments (PLC controllers) are connected, all depending typically on a personal computer used as plant supervisor.

Using a Personal Computer it is possible to acquire all the function information and to program all the instrument configuration parameters. The software protocol adopted fa **MODBUS RTU** type, widely used in several PLC and supervision programs available on the market (X35 series protocol manual is available on request).

The instrument has two terminals called **D+** and **D-** that must be connected to all network terminals with the same label.

For wiring the line, it is advisable to adopt a 3-pole wired and shielded cable connected as shown.



The interface circuit allows the connection of up to **32** instruments on the same line.

To maintain the line in rest conditions a 120Ω resistance (**Rt**) must be connected to the end of the line.

If the instrument is equipped with a serial interface, the parameters to be programmed are those present at parameters group]tS:

- t.AS Address of the station. Set a different number for each station, from 1 to 255.
- t.br Serial interface baud rate. Settings available:
1 = 9600 baud, 2 - 19200 baud, 3 - 38400 baud.

ACCESSORIES

The instrument is equipped with a connector that allows the connection to some accessories.

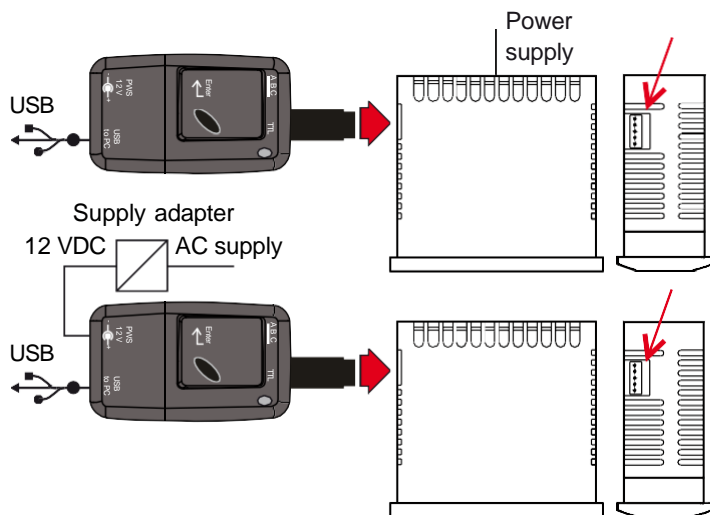
6.1 Parameters configuration by "A01"

The instrument is equipped with a 5 poles connector that allows the transfer from and toward the instrument of the functioning parameters through the device **A01**.



This device it is mainly usable for serial programming those instruments that need the same parameters configuration or to keep a copy of the parameters setting of an instrument and allow its fast duplication.

The same device allows to connect a PC via USB with which, through the appropriate configuration software for "*AT UniversalConf tools*", the operating parameters can be configured. To use the **A01** device it is necessary that the device or instrument are being correctly supplied.



For additional info, please look at the A01 instruction manual.

6.2 Parameters configuration using an NFC Device

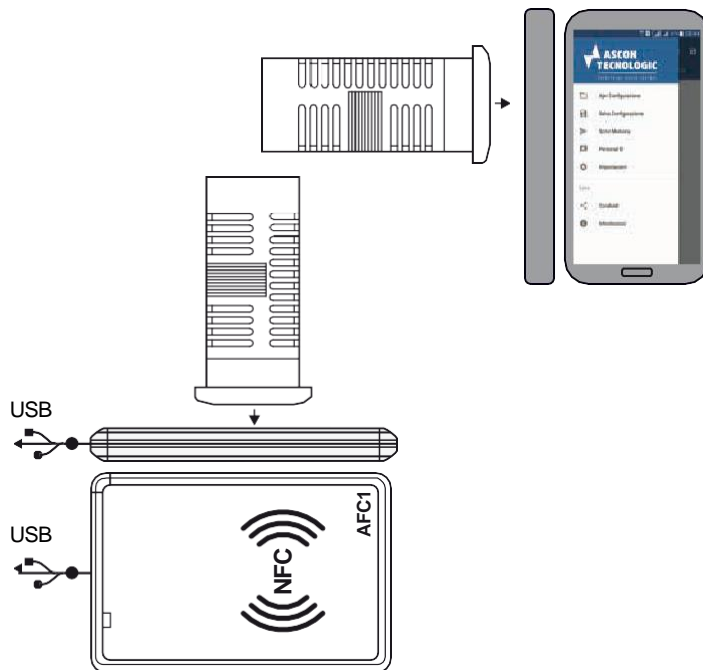
The **AFC1** is a contactless **NFC** (Near Field Communications) connection device that allows to **Upload/Download** the operating parameters **From/To** the instruments. The **AFC1** is powered directly by the **USB** port through which is connected to a **PC**.



When an instrument is equipped with the **NFC** communication option, its operating parameters can be set through a common Personal Computer, the "*AT UniversalConfig*" program and the **AFC1** device or directly from a smartphone equipped with the **NFC** interface and the appropriate "*AT Conf*" App.

Once the changes have been made, the parameters can be sent to the instrument using the **NFC** communications.

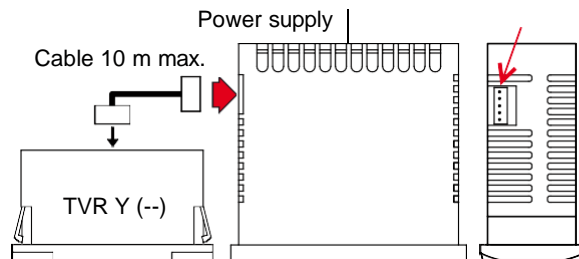
To load the operating parameters in the instrument using the **AFC1** device, place the instrument on the **AFC1** with the display of the controller facing the **NFC** symbol (☎) on the **NFC1** device, then send the parameters to the instrument memory.



To load the program in the instrument using a **Smartphone**, place the **NFC** antenna of the Smartphone facing the display of the controller, then, using the commands of the "*AT Conf*" App download the parameter data (consult the Smartphone manual for details about the NFC antenna position).

6.3 TVR Y remote display

To the instrument it is possible to connect the remote display **TVR Y** through a special cable that can have a maximum length of 10 m. The device **TVR Y**, directly supplied by the instrument, allows to show the temperature measured by the probe **Pr1** through a 2½ digit display.



For additional info, please look at the TVR Y instruction manual.

PROGRAMMABLE PARAMETERS TABLE

Here below is a description of all the parameters available on the instrument. Some of them may not be present, either due to the fact they depend on the type of instrument or because they are automatically disabled as unnecessary.

Note: Those parameters marked with (#) character can be applied to models with Real Time Clock only.

] SP Group - Set Point parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
1	S.LS	2800	Minimum Set Point	-99.9 ÷ S.HS	-50.0	
2	S.HS	2801	Maximum Set Point	S.LS ÷ 999	99.9	
3	SP	2802	Set Point	S.LS ÷ S.HS	0.0	
4	SPE	2803	Eco Set Point	SP ÷ S.HS	2.0	
5	SPH	2804	"Turbo" Set Point (or independent Heating Set Point in mode HC)	S.LS ÷ SP	-2.0	

] in Group - Inputs parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default.	Note
6	i.SE	2805	Probes Type 0 = Pt 1 = nt 2 = P1	Pt PTC nt NTC P1 Pt1000	nt	
7	i.uP	2806	Unit of measurement and resolution (decimal point) 0 = C0 1 = F0 2 = C1 3 = F1	C0 °C with 1° resolution F0 °F with 1° resolution C1 °C with 0.1° resolution F1 °F with 0.1° resolution	C1	
8	i.Ft	2807	Measurement filter 0 = oF 0.1 ÷ 20.0 s	oF Filter disabled 0.1 ÷ 20.0 s	2.0	
9	i.C1	2808	Pr1 Probe Calibration	-30.0 ÷ 30.0 °C/°F	0.0	
10	i.C2	2809	Pr2 Probe Calibration	-30.0 ÷ 30.0 °C/°F	0.0	
11	i.C3	280A	Pr3 Probe Calibration	-30.0 ÷ 30.0 °C/°F	0.0	
12	i.C4	280B	Pr4 Probe Calibration	-30.0 ÷ 30.0 °C/°F	0.0	
13	i.CU	280C	Measure offset on the display	-30.0 ÷ 30.0 °C/°F	0.0	
14	i.P2	280D	Pr2 input function 0 = oF 1 = EP 2 = Au 3 = cd 4 = 2E	oF No function EP Evaporator 1 Au Aux cd Condenser 2E Evaporator 2	EP	
15	i.P3	280E	Pr3 input function 0 = oF 1 = EP 2 = Au	oF No function EP Evaporator 1 Au Aux	oF	
16	i.P4	280F	Pr4 input function 3 = cd 4 = 2E 5 = dG	cd Condenser 2E Evaporator 2 dG Digital input	oF	
17	i.1F	2810	Function and function logic of digital input DI1 0 No function 1 Door open 2 Door open with fan stop 3 Door open with fan and compressor stop 4 External "AL" alarm 5 External "AL" alarm with deactivation of control outputs 6 Selection of active Set Point (SP-SPE) 7 Switch on/ off (Stand - by) 8 "Turbo" cycle activation 9 Remote command of AUX output 10 Disable recording of HACCP alarms 11 Reset of HACCP alarms 12 External "PrA" alarm 13 External "HP" alarm 14 External "LP" alarm 15 Forcing events Switch ON/OFF (Stand - by) 16 Start Defrost 17 Stop Defrost 18 "Turbo" cycle start with monostable command 19 Inhibition of programmed by clock events			
18	i.1t	2811	Delay in acquiring digital input DI1 0 = oF 0.01 ÷ 99.59 (min. s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
19	i.2F	2812	Function and function logic of digital input DI2 See paarameter (17)i.1F		0	
20	i.2t	2813	Delay in acquiring digital input DI2 0 = oF 0.01 ÷ 99.59 (min. s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	

Parameter	HEX. address	Description	Modbus Range	Display Range	Default.	Note
21	i.3F	2814	Function and function logic of digital input Pr3	Vedere il parametro (17) i.1F	0	
22	i.4F	2815	Function and function logic of digital input Pr4		0	
23	i.Et	2816	Delay to Eco mode with door closed	0 = oF 0.01 ÷ 99.59 (h.min.)	oF Delay disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF
24	i.tt	2817	Time-out ECO mode	0 = oF 0.01 ÷ 99.59 (h.min.)	oF Not active 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF
25	i.dS	2818	Variable visualized normally on display:	0 = P1 1 = P2 2 = P3 3 = P4 4 = Ec 5 = SP 6 = rE 7 = oF	P1 Probe Pr1 measure P2 Probe Pr2 measure P3 Probe Pr3 measure P4 Probe Pr4 measure Ec Pr1 in normal mode, Eco in Eco mode SP Active Set Point rE No function oF Display off	P1

] df Group - Defrost control parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Def.	Note
26	d.dt	2819	Defrosting Type	0 = EL 1 = in 2 = no 3 = Et 4 = HG	EL Electrical heating/stop. compr. in Hot gas/reverse cycle no Without compressor output conditioning Et Electrical heating with evaporator temperature control HG HOT-GAS defrost for centralized plants	EL
27	d.dC	281A	Defrosting starting mode	0 = rt 1 = ct 2 = cS 3 = cL	rt Real time intervals ct ot output ON time intervals cS Defrost when ot switches OFF (+ rt intervals) cL By real time clock	rt
28	d.di	281B	Defrosting interval	0 = oF 0.01 ÷ 99.59 (h.min.)	oF Defrost interval disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	6.00
29	d.Sd	281C	Delay first defrost after power-on	0 = oF 0.01 ÷ 99.59 (h.min.)	oF Defrost at power-ON 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	6.00
30	d.dd	281D	Dynamic Defrost Percentage reduction	0 ÷ 100%		0
31	d.dE	281E	Lenght (max.) of defrost cycle (evaporator 1)	0 = oF 0.01 ÷ 99.59 (min.s)	oF Interval and the manual defrosts disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	20.0
32	d.dL	281F	Defrost display Lock	0 = oF 1 = on 2 = Lb	oF Display free on Lock on temperature Pr1 before defrost Lb Lock on label dEF (in defrost) and PdF (post-defrost)	oF
33	d.tE	2820	Defrost stop temperature (evap. 1)	-99.9 ÷ 999 °C/°F		8.0
34	d.Ei	2821	Defrosting interval for evaporator probe error	0 = oF 0.01 ÷ 99.59 (h.min)	oF Interval disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	6.00
35	d.EE	2822	Lengh of defrost cycle for evaporator probe error	0 = oF 0.01 ÷ 99.59 (min.s)	oF Parameter disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	10.0
36	d.tS	2823	Defrost enable temperature	- 99.9 ÷ 999 °C/°F		2.0
37	d.tF	2824	Defrost start temperature	- 99.9 ÷ 999 °C/°F		-99.9
38	d.St	2825	Defrost start delay by evaporator temperature	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	1.00
39	d.cd	2826	Delay start Defrost by continuous compressor running time	0 = oF 0.01 ÷ 99.59 (h.min)	oF Delay disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF
40	d.td	2827	Compressor delay after defrost (drainage time)	0 = oF 0.01 ÷ 99.59 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF
41	d.d2	2828	Lenght (max.) of defrost cycle evaporator 2	0 = oF 0.01 ÷ 99.59 (min.s)	oF Parameter disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF
42	d.t2	2829	Defrost stop temperature evaporator 2	- 99.9 ÷ 999 °C/°F		8.0

] re Group - Temperature control parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
43	r.d	282A	Differential (Hysteresis)	0.0 ÷ 30.0°C/°F	2.0	
44	r.Ed	282B	Differential (Hysteresis) in Eco mode	0.0 ÷ 30.0°C/°F	4.0	
45	r.Hd	282C	Differential (Hysteresis) in Eco mode in Turbo mode or Heating HC mode.	0.0 ÷ 30.0°C/°F	1.0	
46	r.t1	282D	Output activation time for probe error	0 = oF 0.01 ÷ 99.59 (min.s) oF Activation time disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
47	r.t2	282E	Output deactivation time for probe error	0 = oF 0.01 ÷ 99.59 (min.s) oF Deactivation time disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
48	r.HC	282F	Output operating mode	0 = H 1 = C 2 = nr 3 = HC 4 = C3 H Heating C Cooling nr Neutral Zone HC Neutral Zone with independent Set point C3 Cooling with 3 automatic switch modes	C	
49	r.tC	2830	Lengh of Turbo cycle	0 = oF 0.01 ÷ 99.59 (h.min) oF Turbo cycle disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	oF	

] fn Group - Evaporator fans control parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
50	F.tn	2831	Fan time activation with ot output (compressor) OFF	0 = oF 0.01 ÷ 99.59 (min.s) oF FN OFF when ot OFF 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	5.00	
51	F.tF	2832	Fan time deactivation with ot output (compressor) OFF	0 = oF 0.01 ÷ 99.59 (min.s) oF If f.tn = any value, FN ON when ot OFF 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
52	F.FL	2833	High temperature fan deactivation	- 99.9 ÷ 999 °C/°F	10.0	
53	F.LF	2834	Low temperature fan deactivation	- 99.9 ÷ 999 °C/°F	-99.9	
54	F.dF	2835	Differential fan control	0.0 ÷ 30.0°C/°F	1.0	
55	F.FE	2836	Fan status during defrost	0 = oF 1 = on oF - on	oF	
56	F.Fd	2837	Fan delay after defrost	0 = oF 0.01 ÷ 99.59 (min.s) oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	

] pr Group - Compressor protection and power on delay parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
57	P.P1	2838	Output ot delay at switch ON	0 = oF 0.01 ÷ 99.59 (min.s) oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
58	P.P2	2839	Output ot delay after switch OFF	0 = oF 0.01 ÷ 99.59 (min.s) oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
59	P.P3	283A	Output ot delay between 2 switching-ON	0 = oF 0.01 ÷ 99.59 (min.s) oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
60	P.od	283B	Delay outputs at power ON	0 = oF 0.01 ÷ 99.59 (min.s) oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	

] al Group - Alarms parameters




Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
61	A.y1	283C	Temperature alarms 1 Type	1 Absolute to Pr1 probe with label (H - L); 2 Relative to Pr1 probe with label (H - L); 3 Absolute to Au probe with label (H - L); 4 Relative to Au probe with label (H - L); 5 Absolute to cd probe with label (H - L); 6 Absolute to Pr1 probe with no label; 7 Relative to Pr1 probe with no label; 8 Absolute to Au probe with no label; 9 Relative to Au probe with no label; 10 Absolute to cd probe with no label; 11 Absolute to EP probe with no label; 12 Absolute to EP probe with label (H - L).	1	
62	A.H1	283D	High temperature Alarm 1 threshold	-100.0 = oF -99.9 ÷ 999 °C/°F oF Max. alarm disabled -99.9 ÷ 999 °C/°F	oF	
63	A.L1	283E	Low temperature Alarm 1 threshold	-100.0 = oF -99.9 ÷ 999 °C/°F oF Min. alarm disabled -99.9 ÷ 999 °C/°F	oF	
64	A.d1	283F	Alarms A.H1 and A.L1 Hysteresis)	0.0 ÷ 30.0°C/°F	1.0	

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
65	A.t1	2840	Alarms A.H1 and A.L1 delay	0 = oF 0.01 ÷ 99.59 (h.min)	oF Dealy disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF
66	A.P1	2841	Temperature Alarms 1 delay at power on	0 = oF 0.01 ÷ 99.59 (h.min)	oF Power ON dealy disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	2.00
67	A.A1	2842	Alarms H1 e L1 actions	0 No actions 1 Activate alarm outputs 2 Disable (ot e HE) but not activate alarm outputs 3 Disable (ot e HE) and activate alarm outputs		1
68	A.y2	2843	Temperature alarms 2 Type	Vedere il parametro (61) A.y1		3
69	A.H2	2844	High temperature Alarm 2 threshold	-100.0 = oF -99.9 ÷ 999°C/°F	oF Max. alarm disabled -99.9 ÷ 999 °C/°F	oF
70	A.L2	2845	Low temperature Alarm 2 threshold	-100.0 = oF -99.9 ÷ 999°C/°F	oF Min. alarm disabled -99.9 ÷ 999 °C/°F	oF
71	A.d2	2846	Alarms A.H2 and A.L2 Hysteresis)	0.0 ÷ 30.0°C/°F		1.0
72	A.t2	2847	Alarms A.H2 and A.L2 delay	0 = oF 0.01 ÷ 99.59 (min.s)	oF Dealy disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF
73	A.P2	2848	Temperature Alarms 2 delay at power on	0 = oF 0.01 ÷ 99.59 (min.s)	oF Power ON dealy disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	2.00
74	A.A2	2849	Alarms H2 e L2 actions	0 No actions 1 Activate alarm outputs 2 Disable (ot e HE) but not activate alarm outputs 3 Disable (ot e HE) and activate alarm outputs		1
75	A.dA	284A	Temperature Alarms 1 delay after defrost, and unlock display delay after defrost	0 = oF 0.01 ÷ 99.59 (h.min)	oF Dealy disabled 0.01 ÷ 9.59 (h.min) ÷ 99.5 (h.min x 10)	1.00
76	A.oA	284B	Alarm delay with door open	0 = oF 0.01 ÷ 99.59 (min.s)	oF Dealy disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	3.00
77	A.r1 (#)	284C	A.H1 / A.L1 delay to be recorded as an HACCP alarm	0 = oF 0.01 ÷ 99.59 (min.s)	oF Alarms never registered as HACCP 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF
78	A.r2 (#)	284D	A.H2 / A.L2 delay to be recorded as an HACCP alarm	0 = oF 0.01 ÷ 99.59 (min.s)		oF
79	A.bo (#)	284E	Black out alarm delay to be recorded as an HACCP alarm	0 = oF 0.01 ÷ 99.59 (min.s)	oF HACCP recording disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF
80	A.di (#)	284F	DI external alarm to be recorded as an HACCP alarm	0 = oF 0.01 ÷ 99.59 (min.s)		oF

] ou Group - Outputs and buzzer configuration parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
81	o.o1	2850	OUT1 function	0 = oF 1 = ot 2 = dF 3 = Fn 4 = Au 5 = At 6 = AL 7 = An 8 = -t 9 = -L 10 = -n 11 = on 12 = HE 13 = 2d 14 = L1 15 = L2 16 = CS 17 = dH	oF No function ot Temperature control (compressor) dF Defroster 1) Fn Fan Au Auxiliary At Silenceable alarm AL Not silenceable Alarm An Stored alarm -t Silenceable alarm -L Not silenceable Alarm -n Stored alarm on ON when instrument switch ON HE Heating (Neutral zone control) 2d Defroster 2 L1 Light in Eco mode (ON with SP/OFF with SPE) L2 Internal light (Door close: OFF/Door open: ON) CS Output active when variable speed compressor is running dH Pre- and post-defrost output	CS
82	o.o2	2851	OUT2 function		dF	
83	o.o3	2852	OUT3 function		Fn	
84	o.o4	2853	OUT4 function		Au	
85	o.bu	2854	Buzzer function mode	oF Buzzer disabled 1 Active alarms only 2 Key pressed only 3 Active alarms and key pressed	3	
86	o.Fo	2855	Function mode auxiliary output	oF No Function 1 Aux. output delayed than ot control output 2 Manual activation by key or digital input 3 Output Suction solenoid (HOT GAS defrost in centralized plants)	oF	
87	o.tu	2856	Time relative to auxiliary output	0 = oF 0.01 ÷ 99.59 (min.s)	oF Time relative to auxiliary output disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF

] ts **Group - Keyboard and serial communications parameters**

Parameter		HEX. address	Description	Modbus Range	Display Range	Default	Note		
88	t.UF	2857	Function mode key 	oF No function 1 Auxiliary output command 2 Normal/Eco mode Selection 3 Switch ON/OFF (Stand-by) 4 Turbo cycle command 5 Manual Switch ON/OFF (Stand-by) when set by clock 6 HACCP Alarms Reset 7 HACCP Alarms recording disable/enable		oF			
89	t.Fb	2858	Function mode key  /Aux			oF			
90	t.Lo	2859	Keyboard lock function delay			0 = Disabled (oF) 0.01 ÷ 30.00 (min.s)	oF Delay disabled 0.01 ÷ 9.59 (min.s) ÷ 99.5 (min.s x 10)	oF	
91	t.Ed	285A	Set Point Visibility with fast procedure by key 			oF None 1 SP 2 SPE 3 SP and SPE 4 Active SP 5 SP and SPH 6 SP, SPE and SPH		4	
92	t.PP	285B	Access Password to parameter functions	0 = oF 1 ÷ 999	oF Delay disabled 1 ÷ 999	oF			
93	t.HA (#)	285C	HACCP Alarms Parameters level	1 Visible as protected parameters 2 Visible as unprotected parameters		1			
94	t.AS	285D	MODBUS Station address (for serial communications)	0 = oF 1 ÷ 255		1			
95	t.br	285E	Serial communication baud rate	1 = 9600 2 = 19200 3 = 38400		1			

] cl **Group - Real Time Clock (RTC) setting parameters**

Parameter	HEX. address	Description	Modbus Range	Display Range	De-fault	Note
96	c.CL (#)	2862	Current time and current day of the week b0 ÷ b4 = h b5 ÷ b10 = min b11 ÷ 14 = gg (0 = oF) b15 = Not used	h Hour n Minute d Day of the week (d.1 = Monday ... d.7 = Sunday) d.oF Clock not used		
97	c.dt (#)	2863	Current date b0 ÷ b6 = Year b7 ÷ b10 = Month b11 ÷ 15 = Day date	y Year (10 ÷ 99) M Month (1 ÷ 12) d Day date (1 ÷ 31)		

] ce Group - Clock programmable events parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
98	c.01 (#)	2864	Event 1	h.0 Hour n.0 Minute d.1 Day of the week (d.1 = Monday... d.7 = Sunday) d.8 Every day d.9 From Monday to Friday d.10 From Monday to Saturday d.11 Saturday and Sunday d.oF No day (event disabled) t.1 Event type t.1 Switch ON t.2 Stand-by t.3 Switch ON Aux output t.4 Switch OFF Aux output t.5 Start defrost t.6 Switch to Eco mode (SPE) t.7 Switch to normal mode (SP)	h.0 n.0 d.oF t.1	
		287D				
99	c.02 (#)	2865	Event 2			
		287E				
100	c.03 (#)	2866	Event 3			
		287F				
101	c.04 (#)	2867	Event 4			
		2880				
102	c.05 (#)	2868	Event 5			
		2881				
103	c.06 (#)	2869	Event 6			
		2882				
104	c.07 (#)	286A	Event 7			
		2883				
105	c.08 (#)	286B	Event 8			
		2884				
106	c.09 (#)	286C	Event 9			
		2885				
107	c.10 (#)	286D	Event 10			
		2886				
108	c.11 (#)	286E	Event 11			
		2887				
109	c.12 (#)	286F	Event 12			
		2888				
110	c.13 (#)	2870	Event 13			
		2889				
111	c.14 (#)	2871	Event 14			
		288A				

Note: Events can be found, in R/W, also at hex address 2C00 and later.

] Ha Group - HACCP stored alarms (read only parameters)

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
112	H.01 (#)	2872	Stored Alarm no. 1	A. Alarm type (H1/L1/H2/L2/bo/AL) y. Start year (10 ÷ 99) M. Start month (1 ÷ 12) d. Start date (1 ÷ 31) h. Start hour (0 ÷ 23) n. Start min. (0 ÷ 59) E. Duration (0 ÷ 99 h) e. Duration (0 ÷ 59 min) — Peak max./min. (critical temperature) (-9.9 ÷ 999 °C/°F)		
113	H.02 (#)	2873	Stored Alarm no. 2			
114	H.03 (#)	2874	Stored Alarm no. 3			
115	H.04 (#)	2875	Stored Alarm no. 4			
116	H.05 (#)	2876	Stored Alarm no. 5			
117	H.06 (#)	2877	Stored Alarm no. 6			
118	H.07 (#)	2878	Stored Alarm no. 7			
119	H.08 (#)	2879	Stored Alarm no. 8			
120	H.09 (#)	287A	Stored Alarm no. 9			
121	H.10 (#)	287B	Stored Alarm no. 10			
122	H.dl (#)	287C	Number of HACCP alarms deleted (out of space)	0 ÷ 100	0	

Note: The HACCP alarms can also be read at the hex address 2E00 and later.

] cs - Defrost delay parameters

Parameter	HEX. address	Description	Modbus Range	Display Range	Default	Note
123	d.dP	2891	Pre-defrost delay	0 = oF 0.01 ÷ 99.59 (min. s)	oF Dealy disabled 0.01 ÷ 9.59 (min. s) ÷ 99.5 (min.sx10)	oF
124	d.Pd	2892	Post-defrost delay	0 = oF 0.01 ÷ 99.59 (min. s)	oF Dealy disabled 0.01 ÷ 9.59 (min. s) ÷ 99.5 (min.sx10)	oF

8. PROBLEMS AND MAINTENANCE

8.1 Notifications

8.1.1 Error messages

Error	Reason	Action
E1 -E1 E2 -E2 E3 -E3 E4 -E4	The probe may be interrupted (E) or in short circuit (-E) or may measure a value outside the range allowed	Check the probe connection with the instrument and check that the probe works correctly
epr	Internal EEPROM memory error	Press [P] key
err	Fatal memory error	Replace the instrument or ship to factory for repair

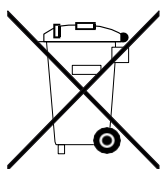
8.1.2 Other messages

Message	Reason
od	Delay at power-on in progress
Ln	Keyboard locked
H1	Maximum temperature alarm 1 in progress
L1	Minimum temperature alarm 1 in progress
H2	Maximum temperature alarm 2 in progress
L2	Minimum temperature alarm 2 in progress
AL	Digital Input alarm in progress
PrA	Digital input alarm PrA in progress
HP	Digital input alarm HP in progress
LP	Digital input alarm LP in progress
oP	Door Open
dEF	Defrost in progress with d.dL = Lb
PdF	Post-defrosting in progress with d.dL = Lb
Eco	Eco Mode in progress
trb	Turbo mode active
HAC	Not acknowledged HACCP alarms present
---	Reset/delete peak values and HACCP alarms
Hon	HACCP Alarms record enable
HoF	HACCP Alarms record disable

8.2 Cleaning

We recommend to clean the instrument with a slightly wet cloth using water and not abrasive cleaners or solvents only.

8.3 Disposal



The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.

9. WARRANTY AND REPAIRS

The instrument is under warranty against manufacturing flaws or faulty material, that are found within 18 months from delivery date. The warranty is limited to repairs or to the replacement of the instrument.

The eventual opening of the housing, the violation of the instrument or the improper use and installation of the product will bring about the immediate withdrawal of the warranty effects. In the event of a faulty instrument, either within the period of warranty, or further to its expiry, please contact our sales department to obtain authorisation for sending the instrument to our company.

The faulty product must be shipped to Ascon Technologic with a detailed description of the faults found, without any fees or charge for Ascon Technologic, except in the event of alternative agreements.

10. TECHNICAL DATA

10.1 Electrical characteristics

Power supply:

12 VDC, 12 ÷ 24 VAC/VDC, 100 ÷ 240 VAC ±10%;

AC frequency: 50/60 Hz;

Power consumption: about 6 VA;

Inputs: Up to 4 inputs for temperature probes (Pr1... Pr4):

NTC (103AT-2, 10 k Ω @ 25°C);

PTC (KTY 81-121, 990 Ω @ 25°C);

Pt1000 (1000 Ω @ 0°C);

up to 4 free of voltage digital inputs ((DI1... DI4)

(2 as an alternative to Pr3 and Pr4);

Output: Up to 4 relay outputs;

	EN 61810	EN 60730	UL 60730
Out1 - SPST-NO - 16A - 1HP 250V	16 (9) A	10 (4) A	12 A Res., 30 LRA, 5 FLA
Out2 - SPDT - 8A - 1/2HP 250 V	8 (3) A	4 (4) A	10 A Res.
Out3/Out 4 - SPST-NO - 5A - 1/10HP 125/250 V	5 (1) A	2 (1) A	2 A Gen. Use

12 A per contact for the model with removable terminals;

Relay output Electrical life (EN60730):

Out1, Out2: 30000 operations, Out3, Out4: 60000 operations;

Action type: Type 1.B (EN 60730-1);

Overvoltage category: II;

Protection class: Class II;

Isolation: Reinforced insulation between the low voltage part (type H supply type and relays output) and front panel; Reinforced insulation between the low voltage section (type H supply type and relay outputs) and the extra low voltage section (inputs), Reinforced between power supply and relay outputs.

10.2 Mechanical characteristics

Housing: Self-extinguishing plastic, UL 94 V0;

Heat and fire resistance category: D;

Ball Pressure Test as described in EN60730: accessible parts 75°C; support live parts 125°C;

Dimensions: 78 x 35 mm, depth 64 mm (+12.5 or +14.5 mm depending on the terminal block type);

Weight: about 150 g;

Mounting: Incorporated flush in panel in a 71 x 29 mm hole (max. panel thickness 12 mm);

Connections:

Inputs: fixed or removable terminal block for 0.14...1.5 mm²/AWG 28...16 cables;

Power supply and Outputs: fixed or removable terminal block for 0.2 ÷ 2.5 mm²/AWG 24 ÷ 14 cables;

Protection degree: IP65 (NEMA 3S) mounted with the optional screw type bracket installed;

Pollution degree: 2;

Operating temperature: 0 ÷ 50°C;

Operating humidity: < 95 RH% with no condensation;

Storage temperature: -25 ÷ +60°C.

10.3 Functional features

Temperature Control: ON/OFF mode;

Defrost control method: Interval cycles, at set times, or evaporator temperature by Electric Heating, hot-gas/reverse cycle or stopping compressor;

Measurement range: **NTC:** -50 ÷ +109°C/-58 ÷ +228°F;

PTC: -50 ÷ +150°C/-58 ÷ +302°F;

Pt1000: -99.9 ÷ +300°C/-99.9 ÷ +572°F;

Display resolution: 1° or 0.1° (range -99.9 ÷ +99.9°);

Overall accuracy: ±(0.5% fs + 1 digit);

Sampling rate: 800 ms;

Clock accuracy at 25°C: ±15.8 minutes/year;

Maintaining the internal clock without power supply:

About 5 years (with internal lithium battery);

Type of Communications Interface: NOT isolated RS485;

Communications protocol: MODBUS RTU (JBUS);

Serial communications speed:

Selectable: 9600, 19200, 38400 baud;

Display: 3 Digit Red (Blue/White optional), height 15.5 mm;

Software class and structure: Class A;

Compliance:

Directive LV 2014/35/EU (EN 60730-1, EN 60730-2-9);

Directive EMC 2014/30/EU (EN55011: class B; EN61000-4-2: 8 kV air, 4 kV cont.; EN61000-4-3: 10V/m; EN61000-4-4: 2 kV supply and relay outputs, 1 kV inputs; EN61000-4-5: supply 2KV com. mode, 1 kV\ diff. mode; EN61000-4-6: 3V)

Regulation 37/2005/CE (EN13485 air/air, S, A, 1, -50°C +90°C with probe NTC 103AT11 or Pt1000 clas B or better).

11. HOW TO ORDER

MODEL

X35- - Instrument with mechanical keyboard

a: POWER SUPPLY

H = 100 ÷ 240 VAC

G = 12 ÷ 24 VAC/VDC

X = 12 VDC

b: OUT3 OUTPUT and Out4

R = Out3 + Out4 Relay SPST-NO 5A(for resistive loads)

A = Out3 Relay SPST-NO 5A(for resistive loads)

- = Not present

d: TERMINALS

V = Fixed Screw power terminals (standard)

E = Removable screw power terminals

F = Faston terminals

N = Removable screw power terminals (the fixed part only)

e: DISPLAY

I = Red

L = Blue

T = White

f: SERIAL INTERFACE

X = RS485 not isolated

- = Not present

g: BUZZER and RTC

A = Buzzer + RTC

B = Buzzer only

C = RTC only

- = Buzzer and RTC not present

h: NFC PROGRAMMING INTERFACE

N = With NFC programming interface

- = Not present

j: PACKAGING + BRACKET TYPE

L = AT package + "Butterfly" type brackets (standard);

V = AT package + Screw type bracket

X35- - **a** **b** - **d** **e** **f** **g** **h** **i** **j** **k** **ll** **mm**

c, i, k: RESERVED CODES;

ll, mm: SPECIAL CODES.